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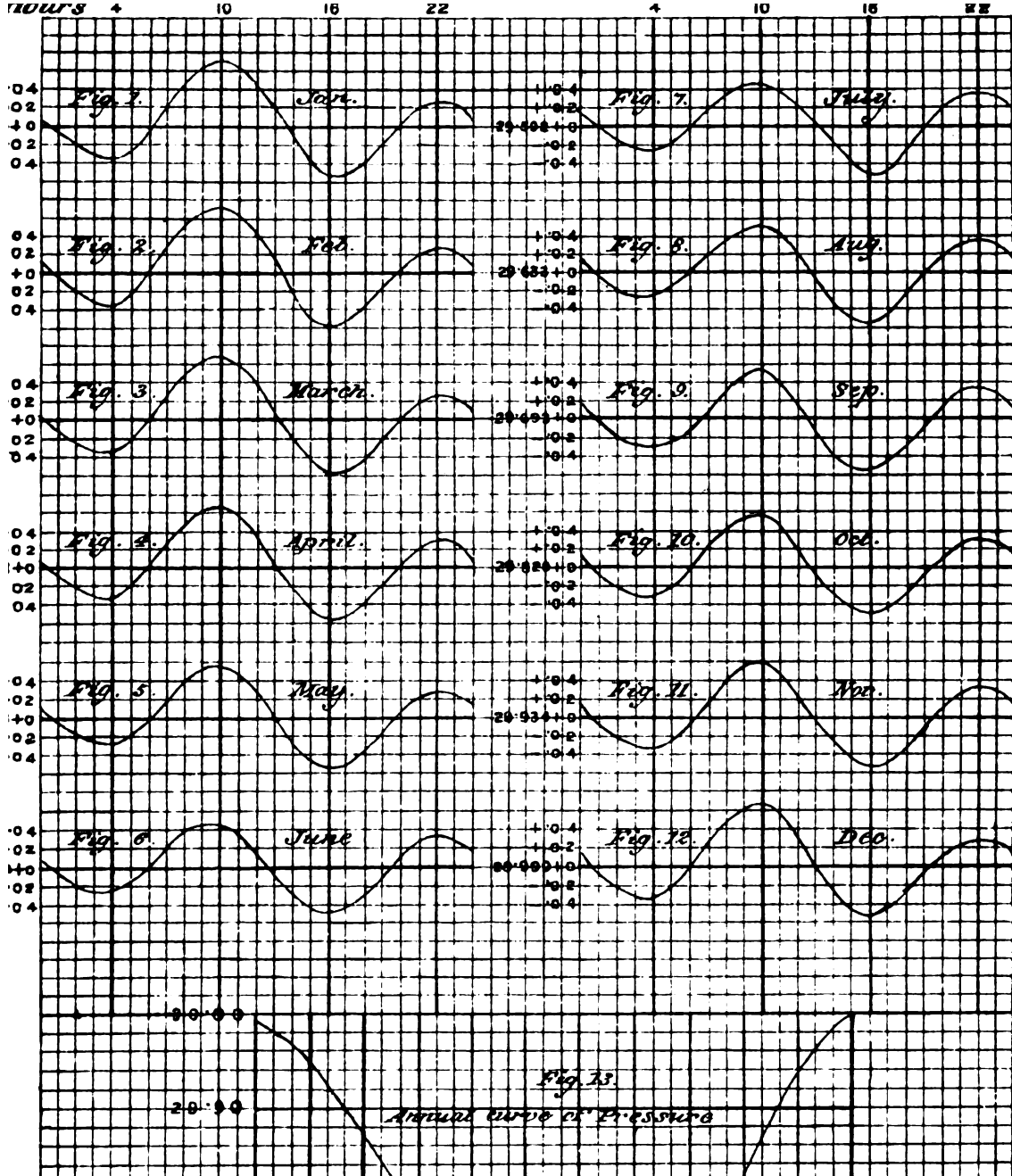
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# Notes on the meteorology of Vizagapatam

Walter Arnold Bion

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*5 Dec. 1899 - 13 Apr. 1900.*









NOTES  
ON THE  
METEOROLOGY  
OF  
VIZAGAPATAM.

BY  
W. A. BION,  
ASTRONOMER, G. V. JUGGAROW OBSERVATORY, VIZAGAPATAM.



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PART I.—RAINFALL.

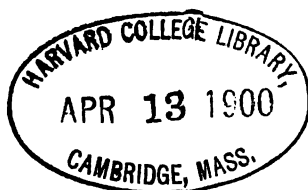
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# NOTES

ON THE

## METEOROLOGY OF VIZAGAPATAM.

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### PART I.—RAINFALL.

**Topography of Vizagapatam.**—The town of Vizagapatam is situated in a small bay on the western coast of the Bay of Bengal, in the district of the same name, in the territory known as the Northern Circars. The town is built on low-lying ground at the mouth of a small river which flows into the sea to the south of it; and an extensive swamp formed by the river and known as the Vizagapatam Back-water is its boundary on the west. About two and a half miles to the north-east is the station of Waltair, built on low sand hills on the sea shore, and hence at a higher elevation than the town of Vizagapatam. A semi-circle of low hills, ranging up to a height of about 1,500 feet, surrounds Vizagapatam and Waltair on all sides except that facing the sea.

The G. V. Juggarow Observatory is situated between Vizagapatam and Waltair in Lat.  $17^{\circ} 42' N.$ , and Long.  $83^{\circ} 22' E.$  at an elevation of about 30 feet above sea level.

The rainfall of Vizagapatam may be described under three heads, depending on the period of the year of its occurrence and upon its character, (1) The spring and early summer thunder-storm rainfall, (2) the south-west monsoon rainfall, and (3) the north-east (or the retreating south-west) monsoon rainfall.

**Spring and Early Summer Thunder-Storm Rainfall.**—This section includes all rain received from January to the setting in of the south-west monsoon which generally takes place in the second week of June.

The north-east monsoon usually comes to an end at Vizagapatam in November, after which the coolest and at the same time the driest period of the year sets in. Very little rain is received in December, January and February, but as temperature rises in March there is a marked increase in rainfall. Temperature and rainfall continue to increase together till, in May, just before the commencement of the south-west monsoon, temperature and rainfall reach their maximum. By far the largest amount of rain received during this period of the year occurs in May.

Rainfall varies greatly at neighbouring stations. In the interior and near the Ghâts it is heavier than on the coast, while at stations on the coast there are marked differences, Vizagapatam receiving considerably more than either Coconada or Bimlipatam.

The prevailing wind direction during the hot weather months is south-west. This is probably largely due to the physical conformation of this part of the country, as the Eastern Ghâts run almost parallel with the coast which from about Masulipatam takes a north-easterly course. It is also in part due to the hot weather pressure distribution and to the trough of low pressure which at this time of the year usually lies across Northern India. The winds are hence deflected into a south-westerly direction instead of the more easterly one which might have been expected. The usual alternation of land and sea breezes is at Vizagapatam almost indistinguishable.

The rainfall of this time of the year is almost entirely due to nor' wester, accompanied by thunder and lightning, which generally occur after the maximum temperature of the day has been recorded. From 5 to 9 P.M. is the usual time for these storms which sometimes last for only a few minutes and sometimes for hours, a storm on the 19th May, 1897, lasting for as long as three hours. A bank of strato-cumulus is usually seen early in the afternoon rising up above the low hills to the north-west, accompanied by masses of cumulo-nimbus. The bank of cloud steadily increases and moving in a south-easterly direction covers the greater part of the sky. Just before the storm breaks there is usually a lull in the south-westerly breeze which has been blowing all day, and the wind then blows in a sudden burst from the north-west. The velocity of the wind is considerable but is not uniform, hard gusts alternating with short lulls. The reversal of the wind direction is very sudden and the traces of the self-recording anemograph show that during the storm the wind changes in direction from between north-west to north-east returning to south-west immediately after it. It is also sometimes noticed that the rain clouds after passing out to the sea return after a short interval and give a second shower further to the north-east.

Rain commences almost immediately as the wind changes from south-west to north-west, and is generally moderately heavy during the few minutes it lasts. On the 4th May, 1897, 1.00 inches were received in 45 minutes.

The meteorological changes accompanying this class of storms are interesting. As the storm bursts there is a sudden and often large rise in pressure, and while the storm lasts the barograph trace is very irregular. On 11th May, 1897, the rise, as the storm burst, amounted to

a tenth of an inch in twenty minutes. The changes in temperature and vapour pressure are also remarkable, both falling rapidly and by large amounts immediately the storm commences.

The decrease in temperature and vapour pressure during nor' westers in 1897 are given below :—

Date.		Decrease of temperature.	Decrease of vapour pressure.
April 1st	...	7°·2 in 30 minutes	0°180" in 15 minutes
May 4th	...	15°·0 " 15 "	0°232" " 15 "
" 11th	...	10°·9 " 20 "	0°385" " 20 "
" 16th	...	7°·7 " 30 "	0°081" " 30 "
" 19th	...	10°·2 " 30 "	0°288" " 15 "
" 27th	...	7°·2 " 30 "	0°134" " 30 "
June 2nd	...	5°·8 " 20 "	0°331" " 20 "

On the 13th May, 1897, during a duststorm, the decrease of vapour pressure in ten minutes amounted to 0°451 inch, but as this was due to a hot dry wind from the interior and not to the same cause that gives rise to the decrease during a nor' wester, it is not shown in the above table.

In illustration of the above phenomena a reproduction is given on Plate I, figs. 1 and 2, of the tracings of the Barograph and Thermograph (wet and dry) recorded during the course of one of these storms on the evening of the 4th May, 1897.

The changes in vapour pressure and relative humidity during the storm are shown below :—

	18 hrs.	19 hrs.	19·15. hrs.	19·30. hrs.	19·45. hrs.	20 hrs.	21 hrs.	22 hrs.
Vapour pressure	0·932"	0·944"	0·978"	0·748"	0·715"	0·703"	0·753"	0·825"
Relative humidity	73	74	77	82	93	86	84	86

The following statement gives the record of velocity and direction of the wind on the same evening as shown by the self-recording Beckley's Anemograph at Waltair :—

	18 to 19. hrs.	19 to 19·15. hrs.	19·15 to 20. hrs.	20 to 21. hrs.	21 to 22. hrs.
Velocity in miles per hour	16	14	33	7	11
Direction	S. S. W.	S. S. W.	S. S. W. to N. through West and back to N. N. W.	N. N. W. to S. S. W.	S. S. W.

It will be seen that the wind, after blowing more or less steadily from the south-west and south-south-west all day, at 7-20 P.M. suddenly veered round to north-west and north with greatly increased velocity, blowing in hard gusts, and at the same time precisely (7-20 P.M.) the air pressure began to rise rapidly and rose 0.080 inch in about ten minutes. The barograph tracing is very irregular and jerky while the storm lasted, but as it was one of short duration (it was all over within an hour) this trace does not exhibit the numerous oscillations shown during longer storms of the same class. A fall of temperature took place a few minutes after pressure commenced rising and amounted to 15° in as many minutes. The decrease was by far most rapid during the first five minutes, as during this short interval the trace shows a fall of 12°. Accompanying the decrease in temperature was one in vapour pressure. At 7-15 P.M. vapour pressure was 0.978 inch; fifteen minutes later it was only 0.746 inch, there having been thus a decrease of 0.232 inch in these few minutes. Rain commenced immediately after the first gust of wind, and in three quarters of an hour a fall of 1.09 inches was recorded.

The thermograph does not always show a fall of temperature so uniform and simple in its character. During many of these storms alternate gusts of cold and of dry hot air are experienced, which leave unmistakable records behind them. As an example a copy is given on Plate I, fig. 3, of the thermograph trace during the progress of one of these storms on the evening of the 11th May, 1897. While the wet bulb trace is almost as simple as on the 4th May that of the dry bulb shows a series of strongly marked and rapid changes of temperature.

The following statement shows the amount of the spring and early summer thunder-storm rainfall at Vizagapatam for the past 28 years and the variations of each year's rainfall from the normal :—

YEAR.	January.	February.	March.	April.	1st May to commencement of monsoon.	Total.	Variation from normal.	Date of commencement of monsoon.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	
1870 ...	2.91	0	0	0.78	1.48	5.15	+1.59	18th June
1871 ...	0.10	1.07	2.81	7.37	2.33	13.68	+10.12	20th "
1872 ...	0	0	0	0.10	2.52	2.62	-0.94	21st "
1873 ...	0	0	0	0.10	4.17	4.27	+0.71	23rd "
1874 ...	0.39	0	0	0	2.04	2.43	-1.13	4th "
1875 ...	0.10	0.10	0	0	1.94	2.14	-1.42	16th "
1876 ...	0	0	0	0	2.04	2.04	-1.52	19th "
1877 ...	1.48	1.16	1.55	0	0	4.17	+0.61	16th May
1878 ...	0	0	0.78	0.10	2.52	3.40	-0.16	20th June
1879 ...	0	0	0.10	0	0.29	0.89	-3.17	20th May

YEAR.	January.	February.	March.	April.	1st May to commencement of monsoon.	Total.	Variation from normal.	Date of commencement of monsoon.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	
1880 ...	0.49	0.58	0	2.04	4.37	7.48	+3.92	1st June
1881 ...	0	0	0.68	0.19	1.36	2.23	-1.33	1st "
1882 ...	0.10	0	0	0	3.30	3.40	-0.16	1st July
1883 ...	0.87	0	0	0	0.68	1.55	-2.01	18th June
1884 ...	0.87	0.58	0	0.10	2.33	3.88	+0.32	14th "
1885 ...	0.29	0	1.84	0	0.87	3.00	-0.56	14th "
1886 ...	0	0	0.19	0	1.75	1.94	-1.62	24th May
1887 ...	0	0	0.39	0	2.23	2.62	-0.94	11th June
1888 ...	0	0	0.39	0	3.10	3.49	-0.07	10th "
1889 ...	0	0	0	0.10	0.78	0.88	-2.68	9th "
1890 ...	0	0	0.18	2.10	3.50	5.78	+2.22	14th "
1891 ...	0	0.09	0.27	0.49	0	0.85	-2.71	24th May
1892 ...	0	0	0	0	2.69	2.69	-0.87	9th June
1893 ...	0.39	0.50	1.16	4.47	1.03	7.55	+3.99	13th "
1894 ...	0	0	0	1.24	0.64	1.98	-1.58	10th "
1895 ...	0	0	0	0.15	2.75	2.90	-0.66	14th "
1896 ...	0	0	0.01	1.30	3.12	3.43	-0.13	17th "
1897 ...	0.14	0	1.22	0.25	4.26	5.87	+2.31	10th "
Means for 26 years up to 1895 ...	0.31	0.15	0.40	0.75	1.95	3.56		

The mean for each month is as follows :—

January ...	...	...	...	0.31 inch.
February ...	...	...	...	0.15 "
March ...	...	...	...	0.40 "
April ...	...	...	...	0.75 "
1st May to commencement of monsoon ...	...	...	...	1.95 inches.

It will be seen that the rainfall for the first two months of the year is small. In March as temperature rises the rainfall as compared with that for February nearly triples itself, and thereafter shows a constant large increase reaching its highest point in May. With May is included the first few days of June before the monsoon sets in, but as the rain received in these few days is in almost every year small in amount, by far the largest quantity of the rain shown in the sixth column of the table falls in May. More rain therefore falls in May, the hottest month of the year, than during the whole of the preceding four months.

The most extraordinary fall of rain during the past twenty-eight years was that recorded during a thunderstorm in April 1871, when no less than 6.40 inches were registered from 10 to 16 hours on the 16th of that month. The old records of the observatory, however, were unfortunately not always kept with the care and accuracy desirable in such matters and there seems good reason to doubt whether this abnormally large fall is not really a clerical error in the register. The next largest



fall is that of 2.57 inches recorded on the 25th April, 1893, between the hours of 7 and 9 p.m. and thus a fall of between two and three inches may be considered an unusually heavy fall for this time of the year, and it would appear unlikely that this has ever been exceeded.

The mean rainfall for the whole period for Vizagapatam is 3.56 inches. The amount for individual years varies from 13.68 inches in 1871 or 7.55 inches in 1893 (if the 1871 records are not considered reliable) to 0.39 inch in 1879. The variations from the normal were largest in the years 1871 (+10.12" ?), 1879 (-3.17"), 1880 (+3.92") and 1893 (+3.99").

The meteorological conditions which might be supposed to influence to some extent the amount of the storm rainfall at this time of the year have been tabulated for the years in which the rainfall for the first five months was (1) in excess, and (2) in defect; but no constant connection can be established between any of the meteorological conditions and the amount of rainfall. This will be more clearly seen by a reference to the accompanying table in which the variation from the normal of each element is shown for each year of extraordinary rainfall.

It must be remembered that the observations from which this table was compiled were taken at 4, 10, 16, and 22 hours. They could not therefore be much affected by the temporary meteorological changes introduced by this class of storms and hence represent very fairly the general conditions prevailing apart from such irregularities. It is much to be regretted that wind observations have to be omitted from this discussion, but the very unsatisfactory exposure of the anemometer and wind vane at this Observatory during past years renders them unreliable and hence probably misleading.

The interaction of the various meteorological conditions is so complicated that it is not always easy to distinguish what determines an excessive rainfall in one year and a defective one in the next. Unusually low pressure, excessive temperature and an unusual quantity of aqueous vapour present in the atmosphere are conditions from which might be expected an unusually heavy rainfall, and the opposite of these conditions the reverse, but the variations of rainfall do not always appear to follow this rule. In the year 1892, for example, pressure from February was in moderate to large defect, the deficiency in March amounting to as much as 0.094 inch and temperature for the same month onwards was considerably in excess. Vapour pressure was either normal or in slight defect for the first three months and in moderate to large excess in April and May, and yet no rain whatever fell in January, February, March and April. In May the rainfall was heavier than usual. In 1880, on the other hand, though pressure was in persistent defect, the deficiency in no month was large, temperature was rather lower than

VARIATION OF VAPOUR PRESSURE FROM NORMAL.							VARIATION OF RELATIVE HUMIDITY FROM NORMAL.						
	January.	February.	March.	April.	May.	Mean.	December.	January.	February.	March.	April.	May.	Mean.
	"	"	"	"	"	"							
1870.	+056	-025	-042	-036	-023	-014	?	-1	-1	-2	-2	-4	-2
1871.	+031	+044	-022	+032	+013	+008	-2	+2	+3	-4	+3	+3	+1
1873.	+011	+013	+003	+002	-007	+018	+9	+1	+1	+1	+2	+2	+3
1877.	+032	+057	+012	-005	+011	+010	+1	+4	+7	+2	0	+3	+3
1880.	+003	-002	-017	+019	-016	-011	0	+1	0	0	+1	+1	+1
1890.	-034	-011	+030	0	+039	0	+2	-2	+1	+1	-1	+1	0
1893.	-009	+060	+036	+088	+045	+035	+3	+2	+6	+7	+8	+6	+5
1897.	+077	+124	+055	+008	+045	+056	-2	+1	+1	+1	-2	+2	0
1872.	+006	+013	+038	+005	+046	+033	+4	-5	0	+1	-2	+1	0
1874.	+018	+010	+014	-006	+004	+013	+7	+3	0	+3	+1	+4	+3
1875.	+003	-045	+023	+031	-003	-005	+4	+2	0	+4	+2	+4	+3
1876.	-028	-016	+068	+048	+060	+022	+3	-2	-1	+5	+3	+4	+2
1879.	-040	-016	+029	+024	-019	+005	+5	-4	0	-2	-1	+2	0
1881.	-065	-109	-054	-010	+002	-037	-4	-6	-10	-5	-2	+2	-4
1883.	-004	-025	-007	-017	+009	-003	+4	0	-4	-2	-1	-1	-1
1886.	-023	-011	0	-019	-001	+001	+6	0	0	0	-1	+4	+2
1887.	+025	-026	-006	-049	+004	-006	+6	+1	-2	-3	-3	-1	0
1889.	+039	-030	-054	0	-018	-014	-3	-2	-5	-6	-4	-3	-4
1891.	-031	+007	+010	-026	-007	+007	+7	-3	0	+1	-6	-1	0
1892.	-023	-002	0	+090	+040	+017	-5	-2	-1	-4	+3	-2	-2
1894.	+031	+026	+043	+022	+028	+029	+6	+3	+3	+2	+3	0	+3
1895.	+021	+001	-053	-054	-032	+014	+7	+2	-2	-5	-4	-3	-1



usual and vapour pressure was much the same as the normal; but the rainfall was abnormally heavy. March was the only month in which less rain than usual was received and in May the rainfall amounted to 4.37 inches or 2.42 inches more than the usual fall for that month. For the whole period the rainfall amounted to 7.48 inches and was one of the three largest amounts recorded during the past twenty-eight years. The year 1877 also affords another example of how the rainfall at this season of the year often shews anomalies which would not be expected from the existing meteorological conditions. The whole of the rainfall of 4.17 inches in 1877 was received during the first three months of the year when the local meteorological conditions cannot be said to have been favorable for excessive rainfall. Pressure was steadily in excess from the preceding December and temperature was below the normal. The unusually large amount of vapour present in the atmosphere during the months of January, February and March, is the only favorable condition, but the excess was not very large and in March amounted to only 0.012 inch. In 1893, also one of the years of greatest excess in rainfall, the only condition apparently in favour of it was that vapour pressure was in excess of the normal.

In 1897, with the exception of the month of April, conditions were peculiarly favourable for excessive rainfall. Pressure was steadily in defect during the first three months of the year and vapour pressure in large excess. Temperature was also in large to moderate excess, the excess in February of the mean temperature for the whole month amounting to 4°.4. In April pressure increased and was in moderate excess, and vapour pressure had decreased to the normal quantity. Temperature continued in moderate excess. Rainfall was heavier than usual in March and considerably in excess during May when the unusually large number of five thunderstorms occurred. In April less rain than usual was received. Other years in which the rainfall appears to agree fairly well with the prevalent local meteorological conditions are 1871, 1881, 1889 and 1890.

It would appear that one of the conditions most constantly accompanying the occurrence of nor' westers is an increase in the amount of aqueous vapour. Frequently for days before a storm occurs, skies cloud over regularly in the afternoon, and each succeeding afternoon the clouds appear thicker till the storm breaks. An examination of the conditions prevailing before each of the storms in the hot weather of 1897 shows that vapour pressure invariably showed a steady increase day after day for three or four days before the storm burst.

In the foregoing table, anomalies in vapour pressure frequently agree with anomalies in the storm rainfall. The agreement is not always apparent, but as these storms would appear to depend largely on conditions varying from day to day, this is not so much to be wondered

at when only monthly means are dealt with. The agreement would perhaps be more clearly traceable if the variations in vapour pressure during each of the 24 hours of the day could be shown. For example in both 1896 and 1897 vapour pressure was in excess in the month of May and more so in 1896 than in 1897, but the rainfall due to thunderstorms in May 1896 was below the normal, while in May 1897 it was above. On comparing the vapour pressure with the normal at each of the four hours at which observations were taken, a result is arrived at which may possibly explain this apparent inconsistency. Thus:—

May.	4 A.M.	10 A.M.	4 P.M.	10 P.M.	Mean.
1896 ...	+ '050"	+ '057"	+ '009"	+ '186"	+ '063"
1897 ...	+ '054"	+ '039"	+ '052"	+ '035"	+ '045"

The excess in vapour pressure in 1896 occurred chiefly during the night when convection due to solar action is at a minimum, and at 4 P.M., after the maximum heat of the day has been attained, vapour pressure was practically normal. In 1897, on the contrary, vapour pressure though not so largely in excess at night was in considerable excess at 4 P.M., the time of day when conditions are peculiarly favourable for the occurrence of thunderstorms. This will perhaps explain why thunderstorms were more frequent in 1897 than in 1896, though at first sight the vapour pressure conditions appeared more favourable in 1896.

When it is also remembered that thunderstorms are often associated with unsettled pressure conditions over a large tract of country and are dependent on the mixture of dry dust-laden air with a moisture saturated current probably at a considerable height above the surface of the earth, it is not surprising that the observations taken at any single station should fail to establish the conditions favourable for their occurrence.

As an interesting fact and one that demonstrates how atmospheric and vapour pressure conditions are influenced by this class of storms, it may be mentioned that the meteorological observations for the hot weather of 1897 show that almost in every case when in the "Weather Remarks" of the day a note appears that distant thunder was heard (though no storm actually visited the station) vapour pressure decreased suddenly and pressure showed unmistakeable signs of unsteadiness in the barograph trace.

The most important points with regard to the spring and early summer thunder-storm rainfall are therefore the following:—

- (1) It increases in quantity as temperature increases, the precipitation in May being greater than that of April and April than of March.
- (2) It usually takes place after the maximum temperature of the day has been recorded.

(3) The prevailing winds at this season of the year are south-westerly, but the rain during these months is invariably received with a wind from the north-west.

(4) The storm breaks with a sudden burst, the wind blowing in hard gusts, and the change in direction of wind is practically instantaneous.

(5) The change of wind is accompanied by a rapid and generally irregular rise of pressure and a rapid fall of temperature and large decrease in vapour pressure.

### THE MONSOON PERIOD.

During the winter or cold weather months pressure is lowest in the sea region to the south of India and in the south of the Bay. As the hot weather sets in and temperature begins to rise in Northern India the distribution of pressure changes. The area of low pressure is gradually shifted northwards and by May a trough of low pressure lies across Northern India preparing the way for, and determining the local variations in the direction of, the monsoon winds. Changes of a similar nature over a larger area are the cause of the monsoon, for with the alteration in the distribution of pressure the south-east trade winds extend to north of the equator where they take a south-westerly course and become the rain-bearing current of the S. W. Monsoon.

The limits of monsoon winds in the Bay of Bengal as laid down by Mr. J. Eliot, F.R.S., Meteorological Reporter to the Government of India, are as follow:—

“From 1st to 31st May may be termed the May, or Hot Weather Transition Period. During this time monsoon winds advance into and establish themselves in the Bay.

“From 1st June to 30th September, the monsoon winds are permanently established over the whole of the Bay and give rain to the whole of North-Eastern India.

“From 1st October to 31st December may be termed the October or Cold Weather Transition Period, during which the monsoon winds gradually cover smaller portions of the Bay and the winds in the lower strata recurve in the centre and are continued as north-easterly winds to the west or Madras coast, where they are known as the North-East or the retreating South-West Monsoon.”

The monsoon current in the Bay is very rarely fully established before the middle of June.

The extreme northern and southern districts on the east coast of India receive their monsoon rainfall at two different seasons of the year. The northern districts obtain their principal rainfall during the four months of June to September, while in the southern districts along the Carnatic coast very little rain falls during these months, but the heaviest rainfall occurs during the retreat of the monsoon from the Bay in the months of October, November and December. Vizagapatam occupies

an intermediate position and as may be expected receives rain during both periods, from both the so called south-west and north-east monsoons. This distribution of rainfall is chiefly due to the lie of the coast which in the Carnatic runs almost due north and south. The humid south-west winds entering the Bay hence do not impinge on this part of the coast and the little rain received during the first part of the monsoon is that carried by the winds of the Arabian Sea branch of the monsoon current over from the West coast, a large proportion of their moisture being lost in crossing the Western Ghats and the high hills in the interior. From Ongole and Masulipatam northwards, however, the coast line takes a north-easterly course and hence a considerable amount of rain is received from this point northward from the Bay monsoon current; especially during the passage up the Bay of cyclonic storms, which give the heaviest bursts of rainfall.

The distribution of rainfall during the monsoon is the reverse of that obtaining during the thunder-storm rainfall period of the spring and early summer; for, while during the latter season, stations in the interior receive more than those on the coast, during the monsoon the coast stations in the Circars, as a rule, receive the larger share. But local variations on the coast continue the same, Vizagapatam again receiving more rain during the monsoon than either Cocanada or Bimlipatam.

The average rainfall at Vizagapatam for each month from the commencement of the monsoon to the end of the year is as follows :—

From the commencement of monsoon to the end of June 4.21 inches.					
During July	...	...	...	4.73	"
„ August	...	...	...	5.69	"
„ September	...	...	...	8.00	"
„ October	...	...	...	11.19	"
„ November	...	...	...	4.89	"
„ December	...	...	...	1.82	"
				<hr/>	
Total				40.53	"

It will be seen that the rainfall increases steadily up to a maximum in October, suddenly falls off in quantity in November and practically ceases in December, more than half of the average fall of 1.83 inches shown for that month being due to abnormally heavy rain received during a cyclone in 1878, amounting to 25.03 inches. The rainfall during June and July is almost the same in amount. In August it increases by an inch and in September it is almost 2½ inches more than in August, while in October it is 3½ inches more than in September.

**The South-West Monsoon.**—The south-west monsoon generally commences at Vizagapatam between the 9th and the 15th

June but the date varies greatly in different years. During the last twenty-eight years the monsoon once commenced as early as the 16th May and once as late as the 1st July. On three other occasions it commenced in May but in twelve of the remaining twenty-two years the date of the commencement of the monsoon fell within the second week in June, which may therefore be taken as the most probable time. The date of the end of the south-west monsoon also varies but the variations are not quite so large as those of the date of its commencement. It generally ends during the first week in October and there is usually a short interval of about ten days of fine weather before the commencement of the so-called north-east monsoon.

The south-west monsoon commences with either a burst of heavy rain or with several days of dark gloomy weather accompanied by a light and more or less continuous drizzle. The heavy rainfall generally accompanies the passage of one of the cyclonic storms which so frequently herald the first advances of the monsoon current up the Bay, while the days of light rain generally occur when either the monsoon breaks without a storm or when the storm forms near the head of the Bay and is too far north to affect Vizagapatam. The initiatory rainfall in these years is probably due more to the monsoon winds blowing over from the west coast than to those of the Bay current.

The average number of days the south-west monsoon lasts at Vizagapatam is 117, of which on an average there are about 39 days in which the rainfall amounts to or exceeds one-tenth of an inch. It will thus be seen that the rainfall at Vizagapatam is of an intermittent character, frequent and prolonged breaks occurring between the bursts of rainfall. These bursts of rain, it has already been mentioned, are very often due to the numerous cyclonic storms of feeble intensity which are formed in the Bay during the continuance of the monsoon. The prevalence of steady south-west winds giving continuous general rain for more than a few days at a time is at Vizagapatam, as elsewhere, of rare occurrence; as the monsoon current is constantly advancing and receding. During the breaks or intervals rainfall is generally scanty and consists of local showers over small tracts of the country. As Mr. J. Eliot has shewn, cyclonic storms or disturbances are a regular and constant feature of the whole of the monsoon period and affect the rainfall to a larger extent than many suppose.

It may also be mentioned that the barometer often falls during the intervals of fine weather and rises again when rain recommences. These oscillations must be distinguished from those connected with the changes indicating the formation or advance of a storm.

The following table gives particulars regarding the south-west monsoons of the past twenty-eight years, from 1870 to 1897.



## SOUTH-WEST

YEAR.	Date of commencement.	Date of ending.	No. of Days.	No. of Rainy days.	RAIN			
					Commencement of Monsoon to 30th June.		July.	
					Amt.	Var.	Amt.	Var.
1870	...	18th June.	17th Oct.	122	51	"	"	"
					6.21	+2.00	3.98	-0.75
1871	...	20th "	28th Sept.	101	34	3.01	-1.20	2.04
1872	...	21st "	6th Oct.	108	55	4.46	+0.25	8.92
1873	...	23th "	4th "	99	33	1.07	-3.14	8.83
								+4.10
1874	...	4th "	16th "	135	51	2.91	-1.30	4.56
1875	...	16th "	6th "	113	28	0.97	-3.24	3.30
								-1.43
1876	...	19th "	4th "	108	38	1.36	-2.85	3.69
1877	...	16th May.	9th "	147	39	13.97	+9.76	3.59
								-1.14
1878	...	20th June.	9th "	112	45	2.72	-1.49	9.22
								+4.49
1879	...	20th May.	12th "	146	44	15.81	+11.60	2.91
								-1.82
1880	...	1st June.	4th "	126	49	3.30	-0.91	8.63
1881	...	1st "	5th "	127	50	7.76	+3.55	2.62
								+3.99
1882	...	1st July.	5th "	97	35	0	-4.21	4.75
								-2.11
1883	...	13th June.	5th "	115	39	1.84	-2.37	2.72
								+0.02
1884	...	14th "	1st "	110	44	2.13	-2.08	2.81
1885	...	14th "	3rd "	112	37	2.33	-1.88	8.59
								-2.01
1886	...	24th May.	30th Sept.	130	50	6.21	+2.00	7.28
								-1.92
1887	...	11th June.	21st "	103	33	7.37	+3.16	6.11
								-1.14
1888	...	10th "	5th Oct.	118	25	1.55	-2.66	3.20
1889	...	9th "	10th "	124	52	3.69	-0.52	8.25
								+2.55
1890	...	14th "	28th Sept.	107	29	3.97	-0.24	3.60
1891	...	24th May.	4th Oct.	124	31	4.63	+0.42	3.63
1892	...	9th June.	1st "	115	33	0.61	-3.60	4.84
1893	...	13th "	23rd Sept.	103	33	2.71	-1.50	5.59
								+0.11
1894	...	10th "	13th Oct.	126	36	2.87	-1.34	2.24
1895	...	14th "	29th Sept.	108	31	6.00	+1.79	1.99
								-2.49
1896	...	17th "	27th "	103	22	1.72	-2.49	7.13
1897	...	10th "	26th "	113	27	0.74	-3.47	1.65
								+2.40
Means up to 1895	...	10th June.	4th Oct.	117	39	4.21	...	4.73
								...

## MONSOON.

## FALL.

August.		September.		1st October to end of Monsoon.		Total for S.-W. Monsoon.			REMARKABLE FALLS OF RAIN.
Amt.	Var.	Amt.	Var.	Amt.	Var.	Total.	Var.	Percentage of variation	
"	"	"	"	"	"	"	"	"	
4.95	-0.75	15.62	+7.62	1.75	+0.67	32.51	+8.80	+37.1	20th September, 3.98 inches.
3.40	-2.29	2.52	-5.48	0	-1.08	10.97	-12.74	-53.7	
7.66	+1.97	7.37	-0.63	2.62	+1.54	31.03	+7.32	+30.9	
9.89	+4.20	3.59	-4.41	0.19	-0.89	23.57	-0.14	-0.6	28th August, 4.17 inches.
3.01	-2.68	8.63	+0.63	3.30	+2.22	22.41	-1.30	-5.6	
3.20	-2.49	9.60	+1.60	1.16	+0.03	18.23	-5.48	-23.1	18th September, 3.88 inches.
5.43	-0.28	6.21	-1.79	0.19	-0.89	16.88	-6.83	-28.8	
3.49	-2.20	9.12	+1.12	0.39	-0.69	30.56	+6.85	+23.9	16th-20th May, 12.70 inches; and 2nd Sept., 4.95 inches.
5.34	-0.35	6.50	-1.50	2.72	+1.64	26.50	+2.79	+11.8	22nd July, 5.14 inches.
2.43	-3.26	3.78	-4.22	1.65	+0.57	26.58	+2.87	+12.1	20th-23rd May, 12.51 inches.
4.95	-0.74	1.65	-6.35	0.49	-0.59	19.02	-4.69	-19.8	
7.28	+1.59	5.63	-2.37	4.17	+3.09	27.46	+3.75	+15.8	9th June, 3.98 inches.
3.01	-2.68	17.27	+9.27	0.49	-0.59	25.52	+1.81	+7.6	9th-10th Sept., 5.52 inches.
11.54	+5.85	6.11	-1.89	0.19	-0.89	22.40	-1.31	-5.6	28th-30th Aug., 5.92 inches.
11.16	+5.47	9.70	+1.70	0.49	-0.59	26.29	+2.58	+10.9	
3.69	-2.00	12.80	+4.80	1.16	+0.08	23.57	-0.14	-0.6	18th September, 7.08 inches.
12.29	+7.60	5.04	-2.96	0	-1.08	31.82	+8.11	+34.2	1st-2nd Aug., 4.95 inches.
5.63	-0.06	6.01	-1.99	0	-1.08	25.12	+1.41	+5.9	11th-12th June, 6.69 inches.
1.65	-4.04	1.16	-6.84	1.26	+0.18	8.82	-14.89	-62.8	
3.40	-2.29	14.36	+6.36	4.66	+3.58	34.36	+10.65	+44.9	18th September, 10.48 inches.
4.10	-1.59	5.57	-2.43	0	-1.08	17.24	-6.47	-27.3	
4.04	-1.65	3.32	-4.68	0.49	-0.59	16.11	-7.60	-32.1	
12.05	+6.36	7.92	-0.08	0.13	-0.95	25.55	+1.84	+7.8	
2.03	-3.66	21.37	+13.37	0	-1.08	31.70	+7.99	+33.7	13th-15th Sept., 17.43 inches.
2.61	-3.08	8.58	+0.58	0.49	-0.59	16.79	-6.92	-29.2	
8.71	+3.02	8.59	+0.59	0	-1.08	25.29	+1.58	+6.7	25th Aug., 3.88 inches; and 3rd-6th Sept., 5.92 inches.
3.16	-2.53	1.59	-6.41	0	-1.08	13.60	-10.11	-42.6	
2.82	-2.87	6.53	-1.47	0	-1.08	11.74	-11.97	-50.5	
5.69	...	8.00	...	1.08	...	23.71	...	...	

It will be seen that, as already stated, the dates of commencement of the monsoon fall within the extreme limits of 16th May in 1877 to 1st July in 1882, but the most usual time is during the second week in June. The extreme limits of the end of the south-west monsoon are from 21st September in 1887 to 17th October in 1870. The length of time the south-west monsoon lasts varies from 97 days in 1882 to 147 days in 1877 while the largest number of actual rainy days (i.e., in which the rainfall amounted to 0·10 inch or more) is only 55 days in 1872 and the smallest number 22 in 1896. No predictions as to the character of the monsoon can be based upon the date of its commencement; for the two extreme dates of 16th May and 1st July both occurred in years when the rainfall was in excess of the normal: in 1886 and 1891 the monsoon commenced on the same date (the 24th May) and yet the rainfall in 1886 was 34 per cent. in excess of the normal and in 1891 was 32 per cent. in defect; and in 1880 and 1881, another pair of years in which the monsoon commenced on exactly the same date, rainfall in one year was 20 per cent. in defect and in the other year 16 per cent. in excess.

If the years are arranged according to variations in rainfall, and all years in which the variations amount to less than 20 per cent. are considered to be normal, the classification will be as follows:—

NORMAL RAINFALL.			EXCESSIVE RAINFALL.			DEFECTIVE RAINFALL.		
Years.		Percentage of variation.	Years.		Percentage of excess.	Years.		Percentage of defect.
1873	...	— 0·6	1870	...	37·1	1871	...	53·7
1874	...	— 5·5	1872	...	30·9	1875	...	23·1
1878	...	+ 11·8	1877	...	28·9	1876	...	28·8
1879	...	+ 12·1	1886	...	34·2	1888	...	62·8
1880	...	— 19·8	1889	...	44·9	1890	...	27·3
1881	...	+ 15·8	1893	...	33·7	1891	...	32·1
1882	...	+ 7·6				1894	...	29·2
1883	...	— 5·5				1896	...	42·6
1884	...	+ 10·9				1897	...	50·5
1885	...	— 0·6						
1887	...	+ 5·9						
1892	...	+ 7·8						
1895	...	+ 6·7						

Years of deficient rainfall are more numerous than years of extraordinarily heavy rainfall, and the percentages of defect are also larger than the percentages of excess. The most extraordinary year on record was 1898 when the amount of rain received during the south-west

monsoon was no less than 62·8 per cent. in defect, which is equivalent to a rainfall of only 8·82 inches instead of the normal quantity of 23·71 inches. The deficiency was greatest in the months of August and September. It may, however, be mentioned that the retreating monsoon made up in some measure for this extraordinarily scanty rainfall by giving slightly more rain than usual in the months of October and November, and thus making the year a less disastrous one from the agricultural point of view than the years 1871, 1891 and 1896 which do not show so large a deficiency in the first part of the monsoon. The year 1871 with a deficiency of 53·7 per cent. comes next and here again the greatest defect occurred in the month of September; but unlike the year 1888 the later rains in October and November practically failed altogether. The south-west monsoon for 1897 shows almost as large a deficiency but happily it was partly made up by a moderately good north-east monsoon. The years 1896 and 1891 are the next most remarkable among the years of scanty rainfall, and they are also remarkable as being the years in which the total annual rainfall was the smallest on record. All five of these years with the exception of 1897 exhibit the same feature of the largest deficiency (both absolute and relative) occurring in September. The remaining five years of deficient rainfall call for no special remark.

The largest amount received in excess of the normal rainfall was 10·65 inches in 1889, and it is noteworthy that the whole of this excess was due to one day's exceptionally heavy rain; for on the 18th September a fall of 10·48 inches was registered, which is the heaviest fall on record for one day for this season of the year. The year 1870 with an excess of 37·1 per cent. comes next and is closely followed by 1886 (+ 34·2%) and 1893 (+ 33·7%). The actual amount of rain received in excess of the normal during these three years varies from 7·99 inches in 1893 to 8·80 inches in 1870. The only other years in which the excess amounted to more than 20 per cent. were 1872 and 1877.

The chief feature in the third list, that of years of normal rainfall, is the remarkable series of ten years from 1878 to 1887, in which all but one (1886) were years of practically normal rainfall; the variations of none of these nine years amounting to as much as 5 inches in excess or defect and in seven out of the nine being under 3 inches.

If the years 1870-96 are divided into three periods of nine years each results are obtained which would appear to give colour to the statement sometimes heard that rainfall is steadily on the decrease.

The first period of nine years (1870-78) is very equally divided into three years of excessive, three of defective, and three of normal rainfall. The second period (1879-87) has no less than eight years of normal and one of excessive rainfall. The third period (1888-96) has two years

normal, two years excessive, and five years defective rainfall. This is better shown by the following statement :—

YEARS.	NUMBER OF YEARS OF			Average Rainfall of the Period.
	Normal Rainfall.	Excessive Rainfall.	Defective Rainfall.	
1870-78     ...	3	3	3	23·64 inches
1879-87     ...	8	1	0	25·31     „
1888-96     ...	2	2	5	21·05     „

The rainfall received during the last nine years has thus been very considerably below the quantity received during the first two periods. Taking each group of nine years it will be seen that while the average monsoon rainfall for 1870-78 was 23·64 inches and for 1879-87 was 25·31 inches, the average for 1888-96 was only 21·05 inches. There has thus been a decrease of 4·26 inches in the average south-west monsoon rainfall of the last nine years, when compared with the nine years immediately preceding or 3·42 inches if the average of the preceding eighteen years is taken. This is a very large decrease when it is remembered that it was distributed over a period of nine years. If the year 1897 be added to the last period the decrease in rainfall would be still more marked, the average for the last ten years being only 20·12 inches. This large decrease in rainfall is chiefly due to the years 1888, 1896 and 1897, but it is a curious fact that no less than six out of the last ten years were years of deficient rainfall.

From the nature of the monsoon current and the region in which it takes its origin, it is evident that the pre-monsoon meteorological conditions prevailing in India cannot be expected to furnish complete data from which the strength or weakness of the current may be predicted. They can be utilized for indicating only the probable distribution of the rainfall, and this can be done only by examining the relative anomalies of pressure, temperature, &c., over the whole of India. Hence the observations at a single observatory are of very little use in determining either the nature or probable distribution of the monsoon rainfall. In illustration of the above remarks, the mean pressure, temperature, vapour pressure and relative humidity anomalies for the months March to May are given below for 1889 and 1893, two years in both of which the south-west monsoon rainfall was in considerable excess, and for 1888 and 1891 in both of which it was in considerable to large defect; and it will be seen how opposite the conditions preceding the monsoon were to each other in each pair of years.

	EXCESSIVE RAIN- FALL.		DEFECTIVE RAIN- FALL.	
	1889.	1893.	1888.	1891.
<i>March.</i>				
Pressure anomaly	+0.041	+0.021	-0.020	-0.008
Temperature do. ...	+0.4	-1.6	+0.4	0
Vapour pressure do. ...	-0.054	+0.036	-0.021	+0.010
Relative humidity do. ...	-6	+7	-3	+1
<i>April.</i>				
Pressure anomaly	+0.026	-0.004	-0.031	+0.038
Temperature do. ...	+1.2	-0.5	+0.6	+1.1
Vapour pressure do. ...	0	+0.038	+0.004	-0.026
Relative humidity do. ...	-4	+8	-2	-6
<i>May.</i>				
Pressure anomaly	+0.030	-0.041	-0.018	-0.025
Temperature do. ...	+0.8	-0.7	+0.2	0
Vapour pressure do. ...	-0.018	+0.045	-0.036	-0.007
Relative humidity do. ...	-3	+6	-4	-1
S.-W. monsoon rainfall do.	+10.65	+7.99	-14.89	-7.60

The divergencies are greatest in years of excessive rainfall and the anomalies agree more closely in years of partial failure of the south-west monsoon rains. On examining the pre-monsoon meteorological conditions of all the years in which the south-west monsoon failed, it would indeed appear as though deficient pressure, and excessive temperature and vapour pressure during the months of March, April and May, generally preceded a failure of the south-west monsoon, which is certainly not what would be expected.

A curious coincidence (for perhaps it can scarcely be considered more) is that excessive rainfall in May and during the first few days of June before the south-west monsoon bursts, is almost always followed by defective monsoon rainfall in June. The probability of this coincidence is in the ratio of 13 to 3. In the three years when excessive pre-monsoon rainfall was not followed by deficient rainfall at the commencement of the monsoon, the excess was relatively small, but in all years when the excess was strongly marked deficient monsoon rainfall in June followed without exception. The reverse however does not hold good.

The following table gives all years in which the rainfall in May and the first few days in June before the monsoon commenced was above

the normal, from which it will be seen that the only years in which these conditions were not followed by deficient monsoon rainfall during the remaining days of June were the years 1872, 1887 and 1895. The excess in the rainfall of May and early part of June in all these three years was small, the largest being 0·80 inch in 1895.

YEARS.	Rainfall from 1st May to commencement of monsoon.	Rainfall from commencement of monsoon to 30th June.	Rainfall of the whole S.-W. monsoon.
	Inches.	Inches.	Inches.
1871 ...	+0·38	-1·20	-12·74
1872 ...	+0·57	+0·25	+ 7·32
1873 ...	+2·22	-3·14	- 0·14
1874 ...	+0·09	-1·30	- 1·30
1876 ...	+0·09	-2·85	- 6·33
1878 ...	+0·57	-1·49	+ 2·79
1880 ...	+2·42	-0·91	- 4·69
1882 ...	+1·35	-4·21	+ 1·31
1884 ...	+0·38	-2·08	+ 2·58
1887 ...	+0·28	+3·16	+ 1·41
1888 ...	+1·15	-2·66	-14·89
1890 ...	+1·55	-0·24	- 6·47
1892 ...	+0·74	-3·60	+ 1·84
1895 ...	+0·80	+1·79	+ 1·58
1896 ...	+0·17	-2·49	-10·11
1897 ...	+2·31	-3·47	-11·97

Excessive rainfall in May and the early part of June before the monsoon bursts should therefore be regarded with some suspicion, as possibly preceding a deficient monsoon rainfall in June which has so disastrous an effect on the early crops; and if this also takes place the probabilities are about 2 to 1 that the total rainfall of the south-west monsoon will also be below the normal.

These conclusions, however, should be received with some caution as there are no easily discernible reasons why excessive rainfall in May should be followed by a failure in the monsoon rains. The reverse of these conditions also is not followed by excessive rainfall.

The following is a short summary of the principal features of the south-west monsoon in Vizagapatam.

(1) It generally commences during the second week of June and ends in the first week of October.

(2) Neither the date of commencement, nor the local meteorological conditions prevailing during the preceding months of March, April and May, afford any reliable indications by which the probable nature of the south-west monsoon may be predicted.

(3) The rainfall of the years 1878-85 was remarkably uniform and closely approximated to the normal. But the total rainfall of the last ten years has been remarkably deficient in quantity.

(4) Excessive rainfall immediately preceding the burst of the monsoon is often followed by deficient rainfall at the commencement of the monsoon.

***The North-East Monsoon.***—In September and October temperature commences falling in Northern India, and the area of highest temperature and consequently of lowest pressure moves southward, the first tendency being shown to the establishment of the normal cold weather distribution of pressure. In the transition period of September and October, the area of lowest pressure lies over the Carnatic and Ceylon and the adjacent sea area. The Bay of Bengal monsoon current which has been blowing steadily from the south-west during the preceding months, becomes variable and sometimes easterly in the centre of the Bay, and gradually curving round, in consequence of the change in pressure distribution, begins blowing from between east and north-east on the Carnatic coast, and brings with it the rains known as the north-east monsoon. The so-called north-east monsoon rains are hence caused by the south-west monsoon, in its retreat from the Bay. As the area of lowest pressure retreats further south, the monsoon winds retreat also and the north-east monsoon rains gradually cease. In the extreme south of the Peninsula the heaviest rains are usually received during December, but at Vizagapatam, so much further north, the December rainfall is in ordinary years very small in amount, and the north-east monsoon rains practically cease at the end of November.

From the agricultural point of view the north-east monsoon rains at Vizagapatam are the most important, and they are at the same time the most uncertain. In some years rainfall is continued late into December, but during the comparatively short time the monsoon usually lasts very heavy rain is often received, occasionally equal to and even exceeding the normal rainfall for the whole  $3\frac{1}{2}$  months of the south-west monsoon. In other years, owing to an unusually rapid retreat of the monsoon current, there is practically no north-east monsoon in this part of the country and the rains fail entirely. It is hence essentially a season of extremes. While during the past twenty-eight years there were thirteen years of practically normal south-west monsoon rainfall, when the percentage of variation from the normal did not exceed twenty per cent., the number of normal north-east monsoons during the same period did not exceed nine. It would therefore be of considerable importance to be able to foretell the probable nature of the north-east monsoon with some degree of certainty.

The following table will show the chief features of the north-east monsoon at Vizagapatam during the past 28 years.



YEAR.	Date of commencement.	Date of ending.	Number of days.	Number of rainy days.	RAIN			
					FROM COMMENCEMENT OF MONSOON TO END OF OCTOBER.		NOVEMBER.	
					Amt.	Var.	Amt.	Var.
1870	18th Oct.	5th Nov.	18	13	17.86	+ 7.25	3.20	- 1.69
1871	15th "	8th "	24	3	0.29	- 9.32	0.49	- 4.40
1872	13th "	9th Dec.	57	15	7.28	- 2.83	3.40	- 1.49
1873	6th "	7th "	62	25	16.88	+ 6.77	1.46	- 3.43
1874	21st "	11th "	51	12	17.07	+ 6.96	3.20	- 1.69
1875	19th "	1st Nov.	13	9	7.57	- 2.54	0.10	- 4.79
1876	6th "	3rd "	28	7	18.43	+ 8.32	2.23	- 2.66
1877	12th "	27th "	46	8	2.91	- 7.20	0.68	- 4.21
1878	14th "	10th Dec.	57	27	12.42	+ 2.31	6.60	+ 1.71
1879	30th "	10th "	41	12	2.81	- 7.30	13.10	+ 8.21
1880	10th "	3rd "	54	25	10.57	+ 0.46	10.19	+ 5.30
1881	1st Nov.	29th "	59	7	0	- 10.11	4.66	- 0.23
1882	13th Oct.	1st "	49	19	2.13	- 7.98	12.22	+ 7.33
1883	13th "	4th "	52	13	12.32	+ 2.21	5.24	+ 0.35
1884	15th "	24th Oct.	9	6	5.34	- 4.77	0	- 4.89
1885	12th "	31st Dec.	80	18	6.79	- 3.32	7.66	+ 2.77
1886	1st "	15th "	75	35	29.29	+ 19.18	11.64	+ 6.75
1887	7th "	19th Nov.	44	19	11.35	+ 1.24	3.20	- 1.69
1888	26th "	14th "	19	14	4.56	- 5.55	13.87	+ 8.98
1889	12th "	28th Dec.	77	20	7.44	- 2.67	3.18	- 1.71
1890	8th "	16th "	69	13	7.09	- 3.02	4.68	- 0.21
1891	11th "	2nd "	52	4	0.97	- 9.14	0.11	- 4.78
1892	11th "	1st Nov.	20	17	27.27	+ 17.16	2.25	- 2.64
1893	10th "	14th "	35	17	4.97	- 5.14	10.40	+ 5.51
1894	16th "	6th "	21	14	20.26	+ 10.15	3.07	- 1.82
1895	5th "	1st "	27	9	9.54	- 0.57	0.19	- 4.70
1896	No monsoon.			0	0	- 10.11	0.08	- 4.81
1897	1st Oct.	27th Dec.	88	7	7.41	- 2.70	6.54	+ 1.65
Means up to 1895	14th Oct.	27th Nov.	44	15	10.11		4.89	

## FALL.

1st DECEMBER TO END OF MONSOON.		TOTAL FOR N.-E. MONSOON.			REMARKABLE FALLS OF RAIN.
Amt.	Var.	Amt.	Var.	Percentage of variation.	
"	"	"	"	"	
0	- 1.82	20.56	+ 3.74	+ 22.24	21st-24th October, 13.0 inches.
0	- 1.82	0.78	- 16.04	- 95.36	
3.88	+ 2.06	14.55	- 2.27	- 18.50	
4.27	+ 2.45	22.60	+ 5.78	+ 34.36	24th-26th October, 7.86 inches.
0.49	- 1.33	20.76	+ 3.94	+ 23.42	25th-26th October, 11.64 inches (7.86 inches on 26th).
0	- 1.82	7.66	- 9.16	- 54.48	
0	- 1.82	20.66	+ 3.84	+ 22.83	7th-8th October, 17.65 inches (5.43 and 12.22).
0	- 1.82	8.59	- 13.23	- 78.66	
25.03	+ 23.21	44.05	+ 27.23	+ 161.83	29th October, 5.82 inches; 4th-10th December, 25.03 inches (9.99 inches on 7th).
0.19	- 1.63	16.10	- 0.72	- 4.28	20th-21st November, 8.54 inches.
1.36	- 0.46	23.12	+ 5.30	+ 31.51	13th-14th October, 6.21 inches.
0.10	- 1.72	4.75	- 12.07	- 71.76	
2.23	+ 0.41	16.59	- 0.23	- 1.87	
1.07	- 0.75	18.62	+ 1.80	+ 10.70	30th October to 1st November, 12.42 inches.
0	- 1.82	5.34	- 11.48	- 68.25	
2.81	+ 0.99	17.27	+ 0.45	+ 2.68	Remarkable burst of almost continu- ous rain from 1st to 21st Octo- ber, amounting to 29.00 inches; 23rd November, 5.04 inches.
2.43	+ 0.61	43.36	+ 26.54	+ 157.79	
0	- 1.82	14.55	- 2.27	- 13.50	
0	- 1.82	18.43	+ 1.61	+ 9.57	6th November, 5.63 inches.
2.77	+ 0.95	13.40	- 3.42	- 20.33	
0.56	- 1.26	12.33	- 4.49	- 26.69	
0.29	- 1.53	1.37	- 15.45	- 91.85	
0	- 1.82	29.52	+ 12.70	+ 75.51	17th October, 5.96 inches; 29th Octo- ber to 1st November, 16.03 inches.
0	- 1.82	15.36	- 1.46	- 8.68	
0	- 1.82	23.33	+ 6.51	+ 38.70	19th October, 8.47 inches; 16th to 25th October continuous rain amounting to 19.32 inches.
0	- 1.82	9.73	- 7.09	- 42.15	
0	- 1.82	0.08	- 16.74	- 99.52	
0.08	- 1.74	14.03	- 2.79	- 16.59	
1.82		16.82			

The dates of the commencement of the north-east monsoon vary from 1st October in 1886 and 1897 to 1st November in 1881. Of the 26 years ending with 1895 the monsoon began five times in the first week of October, twelve times in the second week, and seven times in the third week. The most probable time is hence at the end of the second week in October.

The uncertain character of the north-east monsoon is well shown in the dates of its ending. In 1884 it ended on the 24th October or ten days after its commencement, and the next year it continued up to 31st December. During the last 28 years it ended eleven times in November and fifteen times in December. Rainfall in December, however, is usually small in amount, and the light showers sometimes received at the close of the month may probably be due to local causes. Occasionally heavy rain falls in December, but this is usually due to one of the cyclonic storms of the later transition period. As these storms are of comparatively rare occurrence the monsoon rainfall may be said to end by the end of November.

The north-east monsoon period at Vizagapatam may therefore be considered to comprise the second half of October and the whole of November.

The average number of days it lasts is 44, of which only 15 are rainy days. As the normal rainfall of the north-east monsoon is 16·82 inches, the average daily rainfall for each rainy day is hence 1·12 inches. But this varies greatly in different years. The year 1876 was a remarkable one in this respect, for while the total rainfall of the period amounted to 20·66 inches, the number of rainy days was only seven, the average daily rainfall thus being nearly 3 inches.

On the whole therefore rainfall during the north-east monsoon is proportionately much heavier than during the south-west monsoon. A reference to the column giving extraordinary falls of rain will show that on several occasions the rain received in one day amounted to over 5 inches. The largest amount received in one day at this season of the year was 12·22 inches on the 8th October, 1876, and the next largest 9·99 inches on the 7th December, 1878.

The following list of days on which the rainfall exceeded 5 inches may be of interest:—

1874	26th October	...	...	...	7·86 inches.
1876	7th "	...	...	...	5·43 "
"	8th "	...	...	...	12·22 "
1878	29th "	...	...	...	5·82 "
"	6th December	...	...	...	7·37 "
"	7th "	...	...	...	9·99 "
1879	20th November	...	...	...	5·04 "

1886	15th October	...	...	...	5.72 inches.
"	18th "	...	...	...	6.69 "
"	23rd November	...	...	...	5.04 "
1888	6th "	...	...	...	5.63 "
1892	17th October	...	...	...	5.96 "
"	29th "	...	...	...	6.42 "
"	30th "	...	...	...	5.02 "
1894	19th "	...	...	...	8.47 "

There have thus been fifteen days during the last 28 years in which the rainfall exceeded 5 inches, on five of which it amounted to between 7 and 12½ inches.

But, as already stated, the north-east monsoon at Vizagapatam is a most uncertain period. While there are years such as 1878 and 1886 when the rainfall exceeded the normal quantity by more than 150 per cent., in other years the monsoon practically failed altogether. The years 1871, 1891 and 1896 are instances in point. The year 1896 is the worst on record, for during the whole of the north-east monsoon period there was only one shower of rain and that one of less than a tenth of an inch. In 1871 there were three rainy days, but the total quantity received was only three-fourths of an inch.

If the years are classified as in the south-west monsoon section the result is as follows:—

NORMAL RAINFALL.		EXCESSIVE RAINFALL.		DEFICIENT RAINFALL.	
YEARS.	Percentage of variation.	YEARS.	Percentage of excess.	YEARS.	Percentage of defect.
1872	...	1870	...	1871	...
1879	...	1873	...	1875	...
1882	...	1874	...	1877	...
1883	...	1876	...	1881	...
1885	...	1878	...	1884	...
1887	...	1880	...	1889	...
1888	...	1886	...	1890	...
1893	...	1892	...	1891	...
1897	...	1894	...	1895	...
				1896	...

There have thus been nine north-east monsoons of normal, the same number of excessive, and ten of defective rainfall. The remarkable series of normal south-west monsoons during the years 1878-87 has no exact counterpart in the north-east monsoons, but during the years 1879-88 the monsoon was more frequently normal than at any other period, no less than six out of the total of nine normal north-east monsoons occurring during these ten years.

If the twenty-seven years, 1870-96, be divided into three sections of nine years each, the same noteworthy decrease of late years in the amount of rainfall, as was observed in the case of the south-west monsoon, is also seen in the north-east monsoon. The middle period again shows the largest average rainfall. Thus :—

Years.	NUMBER OF YEARS OF			Average rainfall of period.
	Normal rainfall.	Excessive rainfall.	Defective rainfall.	
1870-78 ...	1	5	3	17.25
1879-87 ...	5	2	2	17.63
1888-96 ...	2	2	5	13.78

In the last period of 1888-96 the average annual rainfall was 3.90 inches less than during 1879-87 or 3.71 inches less than the average for the preceding 18 years. As in the case of the south-west monsoon the decrease represents a large amount when distributed over nine years. In the first period there were five years of excessive, in the second five years of normal and in the third five years of defective rainfall.

But though when periods of nine years are dealt with there is a fairly close correspondence between the variations in rainfall of the south-west and north-east monsoons, it must not be supposed that in individual years there is anything approaching to a close similarity between the two monsoon periods; or that the probable character of the approaching north-east monsoon can be predicted from the amount of rainfall received during the south-west monsoon. During the twenty-eight years, from 1870 to 1897, in only ten years were variations from the normal similar, an unusually heavy south-west monsoon rainfall being followed by excessive rain during the north-east monsoon period, and defective rainfall being followed by an unusually dry north-east monsoon. In the remaining 18 years the variations from the normal during the two monsoons were opposite in their character, and bear no perceptible relation to each other.

The nature of the north-east monsoon and the amount of its rainfall depend largely upon the rapidity of the retreat of the monsoon winds from the Bay, which again is determined chiefly by the pressure conditions over the Indian region; unusually high pressure over Northern India, the Peninsula and the adjacent Bay area causing a more rapid withdrawal of the monsoon current than in years of normal pressure. In addition to the above some peculiarity in the nature of the monsoon

current itself may prove to be a factor in determining a scanty or plentiful north-east monsoon rainfall, and it appears possible that the degree of steadiness of the south-west monsoon in the months of June, July, August and September may bear some relation to the rainfall of the north-east monsoon. A comparison has therefore been made between the steadiness of the south-west monsoon and the rainfall of the succeeding north-east monsoon at Visagapatam during the last fifteen years.

It is a well known fact that cyclonic storms are of more frequent occurrence during unsteady monsoons, and the number of cyclonic storms has hence been used as a measure of the steadiness of the monsoon current. All storms in the Bay of Bengal the central depression of which amounted to a tenth of an inch or more have been utilised for the purposes of this comparison, land-formed depressions being excluded. It was not always easy with the references at command to ascertain the exact number of storms in years previous to 1883, and so only the storms from that year have been tabulated. The year 1885 had to be omitted for the same reason.

The following table gives the number of storms during the months of April, May, June, July, August and September of each year and the variation from the normal of the north-east monsoon rainfall of the same year. The years have been arranged according to the variations of rainfall, the first group being of normal years in which the variation did not exceed  $\pm 2$  inches, the second years of excessive, and the third years of defective rainfall.

Years.	Variations, north-east monsoon rainfall.	Number of storms.	REMARKS.
{ 1883 1885 1898 1893	+ 1.80 + 0.45 + 1.61 - 1.46	7 ? 7 7	
{ 1886 1892 1894	+ 28.54 + 12.70 + 6.51	5 6 7	Monsoon unusually steady in August and September.
{ 1884 1887 1889 1890	- 11.48 - 2.27 - 3.42 - 4.49	9 8 6 6	Three disturbances in August not included.
{ 1891 1895 1896 1897	- 15.45 - 7.09 - 16.74 - 2.79	8 9 9 8	Four storms in September alone. Very unsteady in September.

It would appear from the above that the average number of cyclonic storms with a central depression of not less than 0''-100 from April to September in a normal year is seven, that a smaller number is generally followed by more rain than usual during the north-east monsoon and a larger number (which implies an unsteady monsoon current) is often followed by deficient rainfall. The years 1890 and 1894 at first sight appear to be examples of the failure of this theory but a closer examination gives reasons for the apparent failure. It is true that in 1894 there was excessive rainfall with the normal number of storms, but six of the seven occurred during the months of April, June and July and there was only one in August and September, while in the Annual Report of the Meteorological Reporter to the Government of India it is stated that the monsoon current was unusually steady in August and September. It would appear probable that the current, while unsteady during the earlier part of the monsoon, changed its character in August and September and thus prepared the way for an unusually favourable north-east monsoon. In 1890 on the other hand, there were only six storms, which would at first sight promise abundant rainfall, whereas rainfall was actually in defect, but in August in addition to the six mentioned there were three storms which have been omitted, as it is not known whether they were storms of sufficient intensity to be included. If these be added to the six the monsoon would be shown to be unsteady, and the deficiency in the north-east monsoon would be what might have been expected. The year 1899 is the only one which is an undoubted exception to the rule. In this year the south-west monsoon was unusually steady in July and August but withdrew suddenly from North-Western India very early in September, accompanying and probably caused by a large increase of pressure in Northern India, due to an unusually early and severe winter in Yarkand;—probably the earliest and most severe for the past 25 years, as the Meteorological Reporter to the Government of India remarks in his Annual Report.

It is manifestly unsafe to attempt any generalisation from the observations of a single station and from so small a number of years, but the results arrived at do lend a certain air of probability to the supposition that the north-east monsoon rains of at least Vizagapatam depend in some measure on the steadiness of the Bay monsoon current.

The following is a summary of the principal features of the north-east monsoon in Vizagapatam :—

(1) It generally commences at the end of the second week in October and continues up to the end of November.

(2) The average rainfall per day is much heavier than in the south-west monsoon, but the rainfall is at the same time much more uncertain, the annual variations from the normal during the past twenty-eight years ranging from 161 per cent. in excess to 99 per cent. in defect

(3) The rainfall of the period 1878-85 was more uniform than during any other period, and that of the years 1888-96 was remarkably deficient in quantity.

(4) No forecast of the north-east monsoon rainfall at Vizagapatam can be made from the amount of rain received during the south-west monsoon, but there may be some connection between the degree of steadiness of the south-west monsoon, and the rainfall of the north-east monsoon immediately following.

***Storms of the Monsoon Period.***—As already stated cyclonic storms are a constant feature of the whole of the monsoon period. They vary much in character and intensity, from the feeble depressions occurring chiefly during the period when the monsoon is fully established in the Bay, to the severer cyclonic storms and cyclones. Cyclonic storms of considerable intensity may be formed at all times of the monsoon period, but intense cyclones only occur during the two transition periods of May and October.

Shallow depressions, generally of a diffused character and covering a large sea area, within which winds are of only moderate strength, are of most frequent occurrence; and are chiefly of importance because they cause heavy rainfall, both during their passage across the country and also by bringing up with them fresh advances of monsoon winds, which give bursts of heavy rain over large tracts after the depression itself has passed further inland or has filled up. These are the most persistent and long-lived class of storms occurring as they do at a time when the monsoon is at its height. They sometimes traverse the entire breadth of India and occasionally pass out into the Arabian Sea before filling up. It may here be mentioned that while cyclonic storms from the Bay are known to travel across India into the Arabian Sea, no cyclonic storm originating in the Arabian Sea has ever been known to cross India and pass out into the Bay of Bengal. The cyclonic storms affecting Vizagapatam are hence storms which have all originated in the Bay.

The true cyclone is a much severer disturbance than the cyclonic storm of the rains proper. The central depression is very much deeper, the baric gradients are much steeper, covering as it generally does a comparatively small area, and thus the disturbance is of far greater intensity. The true cyclone is also distinguished by the well known central area of calms and light airs which is not present in the feebler cyclonic storms and depressions. The sea in the calm centre is terrific the waves assuming a pyramidal shape owing to this region being the meeting place of heavy seas running in from all directions. Outside



the calm centre is the region of hurricane winds. The storm wave which proves so destructive when the cyclone crosses the coast near an estuary is another feature of this class of storms.

The conditions preceding the formation of a storm in the Bay of Bengal are as follow :—

- (1) Uniformity of pressure, as shown by the observations at the coast stations.
- (2) Light and variable winds, especially at the head of the Bay.
- (3) A smooth sea and often unusually clear fine weather.
- (4) Strong south-west winds over the south of the Bay.

The barometric changes during the formation and advance of a storm are never very large except in the inner area of the severer cyclonic storms and cyclones. The fall of the barometer in the twenty-four hours is not much greater than the amount of the usual daily oscillations or barometric tides.

The following are the distinguishing features of storms in the different months of the year as given by Mr. J. Eliot, F.R.S., Meteorological Reporter to the Government of India, in his "Hand-book of Cyclonic Storms in the Bay of Bengal":—

The cyclonic storm season is from April to December. None of these storms occur in January, February and March.

From the 15th June to 15th September cyclonic storms are frequent but are very rarely of any great intensity.

From 1st April to 15th June and from 15th September to 31st December (the two transition periods), storms are not so frequent. The greater number of those that do occur during these two periods are of the same kind as those occurring from 15th June to 15th September ; but about two in every five are intense cyclones.

*April.*—South-west monsoon winds occasionally enter the south of the Bay in April, hence storms do occur in this month, but are very rare. They usually form in the south of the Bay or in the Andaman sea and generally advance either to the Ceylon or Coromandel coast or to the Lower Pegu coast.

*May.*—Storms are of more frequent occurrence and generally travel westwards to the Coromandel coast or northwards to the head of the Bay.

*June and July.*—Storms are frequent but generally of only moderate intensity. They usually form at the head of the Bay and travel in a west or north-westerly direction.

*August.*—Storms almost as frequent as in July. They occasionally advance northwards across the Bengal coast, but more frequently across the Orissa or Ganjam coast.

*September.*—Storms as frequent as in July and August. They form

further south than in the previous two months. The majority are of small intensity, but occasionally a cyclone occurs.

*October.*—Cyclonic storms occur less frequently in October, than during any of the preceding four months, but the greater proportion of those that do occur cross the coast of the Circars, and hence a larger number of storms have affected Vizagapatam during October than in any other month. A large number of the cyclonic storms in October develop into severe storms and cyclones. Storms in this month originate most frequently in the centre of the Bay, and thus have an extensive sea area to traverse before reaching land, and consequently a longer time to develop and intensify.

*November.*—Storms similar in character to those of October occur in November, but form less frequently and further to the south.

*December.*—Storms very rarely occur in this month and when they do, form in the south of the Bay, and almost invariably travel in a west-north-west direction to the Coromandel Coast. During the past twenty-eight years only one storm crossed the Circars coast in December.

The following is a list of cyclonic storms and cyclones that have crossed the coast near Vizagapatam during past years; together with a few others which, though crossing the coast at some distance, affected the weather at Vizagapatam to a considerable extent. The list has been compiled from the records of the Meteorological Department of the Government of India with the help (from 1870) of the observations taken at this Observatory.

#### LIST OF CYCLONIC STORMS.

MONTH.	YEAR.	DATE.	REMARKS.
May ...	1787	19-20	Great storm at Coringa.
	1877	12-22	Severe cyclonic storm. Crossed Coromandel coast to the south but gave Vizagapatam heavy rain amounting to 12'71 inches from 16th-21st.
	1879	19-24	Severe cyclonic storm. Crossed to north of Madras and advanced northwards inland along the line of coast. Rainfall at Vizagapatam from 20th to 23rd amounted to 12'51 inches.
June ...	1887	11-15	Moderate cyclonic storm. Crossed Ganjam coast near Ganjam. Gave Vizagapatam 6'6 inches of rain on 11th and 12th.
	1893	11-18	Feeble cyclonic storm. Crossed coast between Vizagapatam and Cocanada on 15th. Gave light rain to Vizagapatam which lasted for several days.
July ...	1878	20-30	Moderate cyclonic storm. Crossed Ganjam coast to south of Ganjam. Gave 5'14 inches of rain at Vizagapatam on 22nd.
	1888	11-15	Cyclonic storm. Crossed coast near Gopalpore. Gave Vizagapatam 1'94 inches of rain on the 13th.
	1892	7-13	Moderate cyclonic storm. Formed in Bay opposite to coasts of Circars and Ganjam and advanced northwards crossing coast near Balasore. Gave Vizagapatam light rain.

MONTH.	YEAR.	DATE.	REMARKS.
Augt....	1883	22-26	Feeble cyclonic storm. Crossed to south of Ganjam. Was followed by burst of moderately heavy rain at Vizagapatam on 28th, 29th and 30th, when 5.92 inches were registered.
	1886	12-21	Moderate cyclonic storm. Formed off coast near Masulipatam and advanced along coast in a north-westerly to northerly direction crossing it near Puri. Caused light rain at Vizagapatam from 12th to 18th.
	1887	17-20	Feeble cyclonic storm. Crossed coast near Ganjam. Gave Vizagapatam light rain on 18th and 19th.
	1892	28-31	Moderate cyclonic storm. Formed off Circars coast, advanced north-westwards and crossed Orissa coast. Gave Vizagapatam light rain.
Sept. ...	1898	5-6	"Cyclone" at Vizagapatam.
	1897	30th	"Cyclone" at Vizagapatam.
	1880	12-19	Moderate cyclonic storm. Crossed Ganjam coast but did not affect Vizagapatam.
	1884	16th Sept. to 1st Oct.	Feeble but remarkably long-lived cyclonic storm. Crossed coast between Gopalpur and Vizagapatam. Gave Vizagapatam a succession of showers from 18th September to end of month, heaviest fall being one of 3.59 inches on the 29th.
	1886	28th Sept. to 3rd Oct.	Feeble cyclonic storm. Crossed Circars coast. Gave a fall of 1.94 inches on 30th September, and was followed by a remarkable burst of rain ushering in north-east monsoon, lasting up to 21st October, during the latter part of which period a small cyclone crossed the coast north of Cocanada.
	1889	16-22	Cyclonic storm of considerable intensity formed in Bay and crossed coast on 18th between Vizagapatam and Gopalpur. Gave Vizagapatam heavy rainfall of 10.48 inches on the 18th.
	1892	19-23	Extensive but feeble depression. Crossed Circars coast on 21st. Gave Vizagapatam moderately heavy rain.
	1895	3-7	Severe cyclonic storm. Crossed coast near Cocanada on the 5th. Gave moderately heavy rain amounting to 5.92 inches from 3rd to 6th.
	1897	6-12	Feeble depression. Crossed coast near Gopalpur. Moderately heavy rain at Vizagapatam.
	1800	23-24	Hurricane at Coringa and Masulipatam.
October	1864	25th	Cyclone in north of Bay. Passed over Vizagapatam.
	1874	24-26	Cyclone passed over Cocanada. Gave heavy rain at Vizagapatam amounting to 11.64 inches on 25th and 26th.
	1876	5th	Severe cyclone. Formed to west of Andamans and travelled west-north-west to Vizagapatam. Gave Vizagapatam 17.65 inches rain in two days (7th and 8th) the fall of 12.22 inches on the 8th being the heaviest recorded in one day during the last 28 years.
	1878	13-16	Moderate cyclonic storm. Crossed Circars coast. Gave moderate rain to Vizagapatam.
	1878	28-31	Moderate cyclonic storm. Crossed Circars coast. Gave Vizagapatam 8.54 inches of rain from 28th to 30th.
	1880	12-15	Moderate cyclonic storm. Crossed Circars coast near Vizagapatam. Gave 6.21 inches of rain on 13th-14th.

MONTH.	YEAR.	DATE.	REMARKS.
October	1861	2-9	Moderate cyclonic storm. Crossed Circars coast north of Vizagapatam. Gave one day's moderately heavy rain of 8'20 inches on the 5th.
	1863	26 Oct.-	Moderate cyclonic storm. Crossed coast near Cocanada. Gave Vizagapatam light rain.
	1866	2 Nov. 16-20	Small cyclone. Crossed coast north of Cocanada. Gave Vizagapatam heavy rain during a burst of prolonged rainfall following a storm at the end of September. On 18th October a fall of 6'69 inches was registered.
	1892	13-17	Cyclonic storm of considerable intensity. Crossed coast near Nellore and gave Vizagapatam 5'96 inches of rain on 17th.
	1892	18-21	Cyclonic storm of small extent but of considerable intensity. Crossed coast between Cocanada and Masulipatam on 20th. Gave light rain to Vizagapatam.
	1892	25-31	Feeble but extensive depression. Crossed Coromandel coast near Nellore and gave an unusually heavy burst of rain to the North Madras coast. Vizagapatam received 17'40 inches from 28th October to 1st November.
	1897	1-6	Cyclonic storm of moderate intensity. Lay off coast near Vizagapatam on 1st then moved northwards crossing coast near Gopalpur. Gave Vizagapatam 5'72 inches of rain on 2nd and 3rd.
	1899	12-17	Cyclone passed across Bay from the Andamans to Coringa.
Nov. ...	1870	5	Cyclone formed in the centre of the Bay and travelled to Vizagapatam, where the wind blew with hurricane force and 2'91 inches of rain fell.
	1874	1	Cyclone. Passed over Cocanada from east. Moderately heavy rain at Vizagapatam.
	1878	3-6	Moderate cyclonic storm. Crossed Circars coast. Gave Vizagapatam moderately heavy rain.
	1886	14-24	Large and severe cyclone. Crossed Circars coast on 23rd. Gave 5'04 inches of rain at Vizagapatam.
	1888	26 Oct. to 10 Nov.	Severe cyclone. Crossed coast at Madras far to the south but gave prolonged burst of rain from 30th October to 9th November. The most remarkable fall registered was one of 5'63 inches on 6th November.
	1889	15 to 20	Moderate cyclonic storm. Advanced northwards along coast of Circars and crossed it to south of Gopalpur, but gave only light rain to Vizagapatam.
	1893	5-6	Cyclone of considerable intensity. Though it crossed the Coromandel coast far to the south it gave Vizagapatam a prolonged burst of moderately heavy rain lasting from the 6th to the 14th November.
	1894	27 Oct. to 5 Nov.	Moderate cyclonic storm. Crossed Circars coast on 2nd November, and gave light rain to Vizagapatam.
Dec. ...	1878	4-9	Severe cyclonic storm. Crossed Circars Coast and gave a remarkable burst of heavy rain to Vizagapatam, the heaviest and almost the only heavy rain received in December during the last 28 years. From the 4th to the 10th 25'03 inches were received, the falls on the 6th, 7th and 8th being 7'37 inches, 9'99 inches, and 4'75 inches respectively.

The number of storms affecting Vizagapatam in each month is as follows :—

May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
3	2	3	4	9	14	9	1	45

Though cyclonic storms are very frequent in the Bay during the months of June, July and August, they are generally formed at the head of the Bay and advance across the Bengal and Orissa coasts, and thus do not affect the weather at Vizagapatam to any great extent, except that the rainfall often increases for a time in consequence of the fresh advance of humid winds that generally accompany such storms. The number of storms given in the foregoing list occurring in these three months is therefore small, and it is not till September that the number sensibly increases, to reach its maximum in October. The number falls off again in November to the same as in September and there are practically no storms in December. The months during which storms most frequently visit Vizagapatam are hence September, October and November; and, as from the 15th September the second transition period commences during which the monsoon gradually retreats from the Bay, storms during this period are often of considerable intensity. It thus happens that a large proportion of the storms that do affect Vizagapatam are either severe cyclonic storms or true cyclones. Of the 45 storms in the list, 21 are described as cyclones and severe cyclonic storms.

The most remarkable storms of which records are available are the ones of

1870, 5th November.

1876, 5th October.

1878, 4th–9th December.

The following descriptions of these three storms are taken chiefly from the late Mr. A. V. Nursingrow's notes as published in the old Reports of the Observatory.

1870, 5th November.—This storm apparently reached Vizagapatam at midnight on the 4th. The barometer fell rapidly to its lowest recorded reading of 28·697 (reduced to 32°) at 3-30 A.M. on the 5th. The barometric depression was about 1·140 inches. The wind was most violent from 2-0 to 3-30 A.M., blowing off roofs of houses and tearing trees up by the roots. There was a lull in the wind for about 10 minutes at 2-20 A.M. when probably a portion of the calm centre passed over the station. A remarkable point in the observations recorded is the rapidity with which the barometer fell, and rose again after the storm. In 3½ hours pressure decreased by 0·797 inch, and it rose an inch in 6½ hours from 3-30 to 10 A.M. From the wind directions given it would appear that the centre of the storm passed slightly to

the south of Vizagapatam. The diagram given in Plate II (fig. 1) shows the pressure curve during the storm as deduced from the observations taken at the time.

1876, 5th October.—From the records extant it would appear that this was the severest storm that has visited Vizagapatam during the past 28 years, and it formed the subject of a special report by Mr. J. Eliot, then Meteorological Reporter to the Government of Bengal. The barometer did not fall as low as in the storm of 1870, which was the lowest reading of the barometer ever recorded at this Observatory, but the rainfall was much heavier and though the force of the wind is said to have been less the amount of damage done would seem to have been greater. The rainfall from 4 to 10 P.M. of the 7th amounted to 4·27 inches, from 10 P.M. to 4 A.M. of the 8th to 5·04 inches and from 4 to 10 A.M. to 5·43 inches—a total of 14·74 inches in 18 hours. The following is an account of the storm as given by the late Mr. A. V. Nursingrow.

“It turned out stormy after 4 P.M. of the 7th, north-west winds “blowing furiously and slight lulls occurring at brief intervals for 4 “or 5 minutes. These lulls were frequent up to 10 P.M. At each lull “the wind decreased in violence, never dropped to a calm but recom- “menced in squalls of greater violence attended with rain. After 10 “P.M. the lulls were less and their duration also was less not exceeding “a minute or two. Between 12 P.M. of the 7th and 1 A.M. of the 8th, “that is in one hour, barometer went down as much as 0·147. Between “2 and 3 A.M. of the 8th was the intensity of the storm. Wind seems “to abate after 4 A.M. Very heavy fall of rain, 17·07 inches in 24 hours. “This anomalous fall had so happened to collect waters from all direc- “tions for their last destination when sea was more or less in high tide. “The arrested water falling back caused the swell of waters on the “swamp to 8 feet above the ordinary level. The western border of “Vizagapatam was thereby inundated. The rush was so rapid that the “people were not quite prepared for it. Nearly hundred thatch-roofed “houses were destroyed with the loss of 30 lives. The velocity of the “wind . . . . was less . . . . than the velocity during the “cyclone of 1870. The trees were blown down to south-east and were “chiefly palmyra a few cassuarina and banian trees. The largest tree “was the banian tree blown down opposite the lodge gate of the Daba “Gardens whose girth was 12 feet. The iron dome of the observatory “measuring 12×12 feet was blown off the walls of the Observatory and “came down 33 feet.”

The fall and rise of pressure were both much more gradual in this storm than in the 1870 cyclone as will be seen from the diagram given in Plate II (fig. 2). Pressure at 3 A.M. was about nine-tenths of an

inch below the normal. The barometric depression was hence not so great as it was in 1870.

1878, *4th-9th December*.—The rainfall occasioned by this storm was almost the only heavy rainfall that has been received in December during the past 28 years and it is the only storm that has crossed the Circars coast in that month during the same period. The heavy rainfall and the unusual time of its occurrence are the principal features which make it worthy of special remark. The barometric depression at Vizagapatam was never more than three-tenths of an inch.

The following is a description of the storm given by the late Mr. A. V. Nursingrow. After describing the pressure changes he says: "During the aforesaid oscillations we had high winds from north and north-east and heavy showers on and off which amounted in five days to 25·03 inches. The heaviest fall of rain in 24 hours was 9·99 inches and was between 10 P.M. of the 6th and 10 P.M. of the 7th. The steamer "Coromandel" was wrecked about 15 miles from Vizagapatam. On wind veering from south and south-west rain and wind abated and clouds commenced to clear up and this was from 4 P.M. of the 8th. Although the wind was not so bad yet the continuous showers for more than four days caused floods and thereby burst tanks more or less everywhere. Crops in consequence suffered considerable damage. Ameen of our estate Sher Mohamed Pooram of Vizagapatam District near Chicacole reports that the rainfall measured by him in that quarter on the 7th, 8th and 9th amounted to 45·59 inches and that the tanks that had the reputation of standing the cyclones of 1870 and 1876 have suffered from the present rains."

Of the storms of late years—though none of them affected the weather at Vizagapatam to the same extent as the three just described—may be mentioned (1) the remarkable series of three storms which crossed the coast during the latter half of October, 1892, (2) the cyclone of November 1893, and (3) the cyclonic storm of September, 1895, which last gave a heavy down-pour to the Godavari and Kistna districts causing floods which did great damage. About 50 miles of the railway embankment and ten or twelve bridges were washed away.

*Note.*—Up to May 1896 the gauge used at this Observatory to measure rainfall was one invented by the late Mr. G. V. Juggarow, every fluid oz. of water collected by which was supposed to represent 0·10 inch of rainfall. On examination the funnel was however found not to be truly circular and the diameter instead of being exactly 4·697 inches varied from 4·75 to 4·875 inches.

The appliances used for measuring the fractions of an inch of rainfall were also very rough and could only give approximate results. In order to determine the error of the old raingauge as closely as possible it was placed side by side with a new one (one of Symon's pattern lent by the Government of India), and com-

parative measurements were taken. Results of these show that for every inch collected by Symon's gauge Juggarow's shows 1.03 inch.

As I am informed the same gauge and measuring tin has always been in use, the whole of the rainfall records from 1870 are vitiated by the same error. To reduce them to the correct amount, all measurements of rainfall given in the foregoing paper up to May 1896 (when the new raingauge was brought into use) have been multiplied by 0.97. The figures quoted will hence differ from those given in previous reports.



VIZAGAPATAM MONTHLY RAINFALL.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total for the Year.	Variations from the Normal.
1870	2.91	...	...	0.78	0.10	7.57	3.98	4.95	15.62	19.11	8.20	...	58.22	+ 14.13
1871	0.10	1.07	2.81	7.87	2.33	8.01	2.04	3.40	2.52	0.29	0.49	...	25.43	- 18.66
1872	...	...	...	0.10	1.46	5.63	8.92	7.66	7.37	9.89	8.40	3.88	48.21	+ 4.12
1873	...	...	...	...	3.40	1.84	8.83	9.89	8.59	17.07	1.46	4.27	50.45	+ 6.86
1874	0.89	...	...	...	2.04	2.91	4.56	3.01	8.63	20.87	3.20	0.49	45.60	+ 1.51
1875	0.10	0.10	...	...	1.84	1.07	3.30	3.20	9.60	8.73	8.10	...	28.04	- 18.05
1876	...	...	...	...	1.46	1.94	3.69	5.43	6.21	18.62	2.23	...	89.58	- 4.51
1877	1.46	1.16	1.55	...	12.80	1.16	3.59	3.49	9.12	3.30	0.68	...	88.31	- 6.78
1878	...	...	0.78	0.10	2.43	3.31	9.22	5.34	6.50	15.13	6.60	25.08	73.94	+ 29.85
1879	...	...	0.10	...	14.07	2.04	2.91	2.43	3.78	4.46	13.10	0.19	48.08	- 1.01
1880	0.49	0.68	...	2.04	4.37	3.80	8.63	4.95	1.65	11.06	10.19	1.36	48.93	+ 4.59
1881	...	...	0.68	0.19	1.36	7.76	2.62	7.28	5.63	4.17	4.66	0.10	34.45	- 9.64
1882	0.10	...	...	...	2.33	0.97	4.75	3.01	17.27	2.62	12.22	2.23	45.50	+ 1.41
1883	0.87	...	...	...	0.68	1.84	2.72	11.54	6.11	12.51	5.24	1.07	42.56	- 1.51
1884	0.87	0.58	...	0.10	0.58	3.88	2.81	11.16	9.70	5.82	...	...	35.50	- 8.59
1885	0.29	...	1.64	...	0.39	2.91	3.59	3.69	12.80	7.95	7.66	2.81	48.83	- 0.26
1886	...	...	0.19	...	4.85	8.10	7.28	13.29	5.04	29.29	11.64	2.43	77.11	+ 38.02
1887	...	...	0.39	...	1.07	8.64	6.11	5.63	6.01	11.35	3.20	...	42.30	- 1.79
1888	...	...	0.89	...	3.10	1.55	3.20	1.65	1.16	5.82	13.87	...	80.74	- 13.35
1889	...	...	...	0.10	0.78	3.69	8.25	3.40	14.36	12.10	3.18	2.77	48.63	+ 4.54
1890	...	...	0.18	2.10	1.95	5.62	3.60	4.10	8.32	7.09	4.68	0.56	35.35	- 25.76
1891	...	0.09	0.27	0.49	1.56	3.07	3.63	4.04	3.32	1.46	0.11	0.29	18.33	- 8.74
1892	...	...	...	...	0.26	3.04	4.84	12.05	7.92	27.89	2.25	...	57.75	+ 13.66
1893	0.89	0.50	1.16	4.47	1.03	2.71	5.59	2.08	21.37	4.97	10.40	...	54.62	+ 10.58
1894	...	...	...	1.34	0.06	3.45	2.24	2.61	8.58	20.75	3.07	...	42.10	- 1.99
1895	...	...	...	0.15	2.57	6.18	1.99	8.71	8.59	9.54	0.19	...	37.92	- 6.17
1896	...	...	0.01	1.30	0.96	2.76	7.13	3.16	1.59	...	0.08	...	16.99	- 27.10
1897	0.14	...	1.23	0.25	4.14	0.87	1.65	2.82	6.53	7.41	6.54	0.08	81.05	- 12.44
Means up to 1895	0.31	0.15	0.40	0.75	2.65	3.51	4.73	5.69	8.00	11.19	4.89	1.82	44.09	

## NUMBER OF RAINY DAYS.

YEAR.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total for the year.	Variations from the Normal.
1870	3	..	..	1	1	12	11	13	14	16	8	..	74	+13
1871	1	3	2	4	6	3	9	10	12	2	1	..	54	-7
1872	..	..	..	1	6	9	16	14	14	12	5	3	80	+19
1873	..	..	..	1	2	4	15	11	15	20	4	2	64	+8
1874	2	..	..	..	5	10	9	13	14	14	8	1	70	+9
1875	1	1	..	..	7	4	6	7	11	10	1	..	48	-13
1876	..	..	..	..	3	6	7	13	13	6	2	..	50	-11
1877	1	4	2	1	6	4	8	9	9	9	2	..	54	-7
1878	..	..	2	1	7	4	10	16	12	14	11	7	54	+23
1879	..	..	1	..	8	4	7	8	14	7	9	1	59	-2
1880	3	1	..	4	9	9	16	13	10	13	6	2	90	+39
1881	..	..	3	..	3	15	7	13	14	8	6	1	68	+5
1882	1	..	..	..	9	2	13	7	13	9	11	1	63	+2
1883	1	1	..	..	1	7	10	12	9	10	3	1	54	-7
1884	..	1	..	1	1	7	9	10	13	7	..	..	50	-11
1885	2	..	3	..	1	8	10	8	11	9	6	5	63	+2
1886	..	..	1	..	7	7	13	16	10	23	8	4	88	+27
1887	..	..	1	..	3	8	11	6	8	14	5	..	56	-5
1888	..	..	1	..	2	3	7	8	5	5	11	..	42	-19
1889	..	..	1	..	3	8	14	12	10	19	4	5	76	+15
1890	..	..	1	1	2	8	8	8	8	6	6	1	49	-13
1891	..	..	2	1	2	5	7	7	9	5	..	1	39	-23
1892	..	..	..	3	1	3	7	11	12	17	..	..	52	-9
1893	1	2	2	..	3	6	12	7	8	9	8	..	61	0
1894	..	..	..	4	8	10	6	8	11	13	4	..	56	-5
1895	..	..	..	1	3	9	6	9	9	8	1	..	46	-15
Means up to 1895	0.62	0.46	0.81	0.88	3.81	6.73	9.73	10.31	10.69	10.77	4.85	1.35	61	



NOTES  
ON THE  
METEOROLOGY  
OF  
VIZAGAPATAM.

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PART II.

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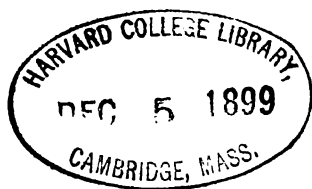
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# NOTES

ON THE

## METEOROLOGY OF VIZAGAPATAM.



### PART II.

The following discussion is based on normals calculated from six-hourly observations taken at the G. V. Juggarow Observatory during the twenty-six years, 1870-1895.

Some difficulty has been experienced in preparing the tables which accompany this paper as no instrumental corrections have ever been applied to the readings recorded in the old registers nor has any proper record been kept of the instruments used. From information supplied by some of the observers who have for many years been working in the observatory a more or less complete list of instruments has been made out, which was supplemented by a memorandum kindly furnished by the Calcutta Meteorological Office. It has thus been found possible to apply corrections to most of the readings and this difficulty has to a great extent been overcome.

Many of the observations recorded in the registers were also found to be clearly incorrect, and a sifting process had to be gone through by which all incorrect or doubtful readings were rejected.

Arithmetical means of each hour of observation for each day of the year were next computed, and the normals thus obtained were subjected to the following process suggested by Mr. J. Eliot, F.R.S., the Meteorological Reporter to the Government of India, by which casual departures were brought within closer range of the general average of variation. The 365 days' means were arranged in line and between

each pair were placed the means of each successive pair giving 365 new means. From these, the first smoothed means, the second, third and fourth and in some cases fifth and sixth smoothed means were similarly computed. Finally the mean was taken of the first fifteen days of the last series of smoothed means, and was placed opposite the 8th January; the mean of the 2nd to the 16th of this series of smoothed means was placed opposite the 9th January, and so on, every day's final mean being the average of its own fourth or sixth smoothed mean and of the seven preceding and seven following it.

Very satisfactory results have been attained by this method, for while the daily means have lost the irregularities they had before undergoing the smoothing process, the monthly means of the unsmoothed figures are almost identical with those of the smoothed means. It should be noted that whenever it was found necessary in Part I of this paper to quote the means of pressure, temperature, etc., the means given were in all cases the unsmoothed figures. Hence they may not in every case agree *exactly* with the normals now published.

**Pressure.**—The barometric observations during the whole period of twenty-six years were taken with a self-adjusting barometer by Negretti and Zambra; and the readings given in the accompanying tables have all been reduced for the usual standard temperature of 32° Fahr.

In a table at the end are given the smoothed means of pressure for each day of the year for each of the four hours of observation, *viz.*, 4, 10, 16 and 22 hours.

The following table gives the mean diurnal maxima and minima for each month, their differences from the mean of the day, the amplitude of the day and night oscillations, and the ratio the oscillations bear to each other. Plate III gives the curves based on this table, showing the variation of pressure at each hour of observation from the mean of the day for each month, and also the range of mean pressure for the year.

Differences of the mean diurnal Maxima and Minima from the Mean Pressure of the day.

	First Min.		First Max.		Second Min.		Second Max.		Mean of four observations.	Amplitude of day oscillation, i.e., change from 1st max. to 2nd min.	Amplitude of night oscillation, i.e., change from 2nd max. to 1st min.	Ratio.
	4 Hours.		10 Hours.		16 Hours.		22 Hours.					
	29 +		29 +		29 +		29 +					
January	·957	·037	1·063	+ ·069	·940	·054	1·016	+ ·022	·994	0·123	0·059	2·1
February	·915	·038	1·025	+ ·072	·894	·059	·979	+ ·026	·963	0·131	0·064	2·0
March	·841	·035	·946	+ ·070	·817	·059	·900	+ ·024	·876	0·129	0·059	2·2
April	·757	·031	·852	+ ·064	·729	·059	·813	+ ·025	·788	0·123	0·056	2·2
May	·657	·028	·740	+ ·067	·626	·057	·709	+ ·026	·683	0·114	0·052	2·2
June	·571	·023	·638	+ ·044	·541	·053	·625	+ ·031	·594	0·097	0·054	1·8
July	·568	·024	·635	+ ·043	·539	·053	·624	+ ·032	·592	0·096	0·056	1·7
August	·607	·026	·682	+ ·049	·576	·057	·666	+ ·033	·633	0·106	0·059	1·8
September	·663	·030	·747	+ ·054	·635	·058	·726	+ ·033	·693	0·112	0·063	1·8
October	·784	·036	·878	+ ·058	·768	·052	·849	+ ·029	·820	0·110	0·065	1·7
November	·898	·036	·993	+ ·059	·883	·052	·963	+ ·029	·934	0·111	0·065	1·7
December	·963	·036	1·061	+ ·062	·945	·054	1·025	+ ·026	·989	0·116	0·062	1·9
Mean	·765	·032	·855	+ ·058	·741	·056	·825	+ ·028	·797	0·114	0·060	1·9



As observations were taken at only six-hourly intervals the maxima and minima shown are only approximate, being the readings of the barometer at 10 and 22 hours; and 4 and 16 hours respectively.

The first or day maximum varies most from the mean during the first four months of the year, especially in February; and the variation of the second or day minimum is largest during February, March, April and September. The amplitude of the day oscillation is hence greatest in February and almost as great in January, March and April. It then decreases and is smallest in June and July. The changes in the second or night maximum are smaller, and while the first (or night) minimum again shows its largest variation from the mean of the day in February, the second maximum attains its greatest variation in June, July, August and September.

The amplitudes of the day and night oscillations when compared with each other show the greatest differences from January to May. Differences are smallest, i. e., the two oscillations most nearly approach each other in amplitude, from June to November. Pressure oscillations at Vizagapatam thus approach the maritime type of equality in amplitude during the months of the south-west and north-east monsoons. The day and night oscillations differ most largely in the hot weather months of March, April and May.

The mean monthly amplitude of the day oscillation varies from 0.131 inch in February to 0.096 inch in July; that of the night oscillation from 0.065 inch in October and November to 0.052 inch in May. The amplitude of the day oscillation hence varies during the year by 0.035 inch or nearly three times as much as that of the night oscillation. The amplitude of the night oscillation is hence a much more constant quantity than that of the day oscillation, and as the changes in the variation of the second or day minimum are small throughout the year the variations in the ratio of the two oscillations depend chiefly upon changes in the first or day maximum.

The foregoing remarks are based on the figures giving the monthly means. If however the daily normals are examined it will be seen that though the monthly means of the ratio show a steady rise and fall during the year the figures for each day of the year show several well defined oscillations which are lost in the monthly means. The ratio increases slowly during January, but during February there is a decided decrease up to about the middle of the month when it again increases. During March and April and the first few days in May the ratio continues pretty constant, but from about the 9th May a steady rise takes place and during the latter part of May the difference between

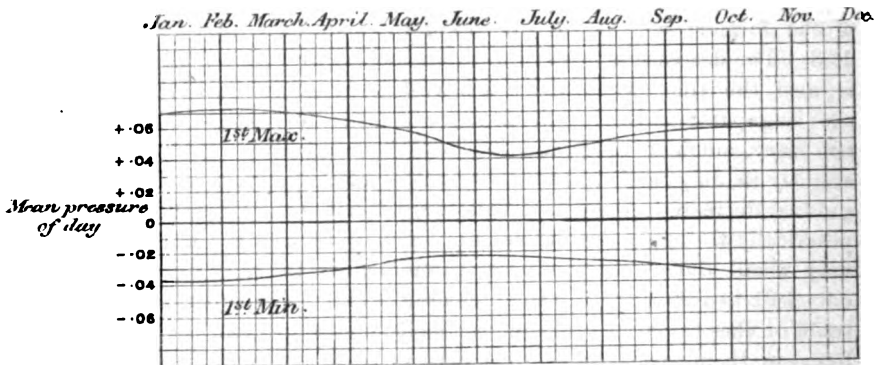
the two oscillations is at its greatest—the ratio standing at about 2·33 to 2·43 ; or, the magnitude of the day oscillation being almost two and a half times that of the night. From the 1st of June the day oscillation steadily decreases in amplitude and the night oscillation increases (the rate of change of the latter being however considerably less than that of the former) so that by the end of the month the ratio decreases to 1·63. The decrease is most rapid from the 9th to 14th of June which is also the time when the south-west monsoon generally commences at Vizagapatam. During the next few months the two oscillations do not vary much in magnitude. The difference between them increases slightly in July and from the beginning of August there is a very gradual decrease to the end of October, when the ratio between them is practically the same as at the end of June. The changes are however very small during this period of three months, the ratio ranging from only 1·91 to 1·60. During the first nine days of November the amplitudes of the oscillations remain practically unchanged, but the difference between them then begins to slowly increase and continues doing so till the end of the year. The increase is however very gradual and there is not the same sudden change as at the commencement of the rains.

In Part I of this paper it was shown that the south-west monsoon generally commences at Vizagapatam during the second week in June and the north-east monsoon generally comes to an end at the close of the second week in November. There is thus a close agreement between the changes in the ratio of the amplitude of the day and night oscillations of pressure, and the commencement and cessation of the rains. And the oscillations most closely approach each other in amplitude, and hence the diurnal changes of pressure at Vizagapatam most closely agree with those observed at sea, during the rainy season.

The variation of the second minimum from the mean of the day is practically the same throughout the year, as the mean monthly variations range only from  $-.052$  inch in October and November to  $-.059$  inch in February, March, April and September. The second maximum changes slightly more, from  $+.022$  inch in January to  $+.033$  inch in August and September, and is closely followed by the first minimum, the variation of which ranges from  $-.023$  inch in June to  $-.038$  inch in February. The variation of the first maximum is the one that changes most largely and the difference in this respect between it and the other three readings is most marked. The variation of the first maximum from the mean of the day changes from  $+.043$  inch in July to  $+.072$  inch in February. The first minimum also attains its largest variation

in February and the changes in its variation follow those of the first maximum very closely but of course with opposite signs.

The following diagram will make this clear :—



The first maximum and the first minimum both approach the mean of the day most closely in June and July, and both show the largest variation from it in the months of October to February.

The two maxima differ from each other by amounts that change more or less regularly (in character not amount) from month to month. Almost the same regularity in the character of the change is seen in the case of the two minima. The following table gives the differences between the two pairs of observations for each month of the year, from which can be seen the amount and character of the monthly changes.

MONTHS.			Difference between first and second maxima.	Change since preceding month.	Difference between second and first minima.	Change since preceding month.
January	...	...	·047	+·011	·017	+·001
February	...	...	·046	-·001	·031	+·004
March	...	...	·046	0	·024	+·003
April	...	...	·039	-·007	·028	+·004
May	...	...	·031	-·008	·031	+·003

MONTHS.			Difference between first and second maxima.	Change since preceding month.	Difference between second and first minima.	Change since preceding month.
June	...	...	·013	—·018	·080	—·001
July	...	...	·011	—·002	·029	—·001
August	...	...	·016	+·005	·031	+·002
September	...	...	·021	+·005	·028	—·003
October	...	...	·029	+·008	·016	—·012
November	...	..	·080	+·001	·016	0
December	...	...	·086	+·006	·018	+·002

The differences between the two maxima are greatest in January and least in July. The monthly changes are remarkably regular in character though in amount they vary considerably. The changes in the differences between the two minima are not very regular in either character or amount, but generally speaking the changes are opposite in character to those of the two maxima. In the case of the minima the difference is greatest in the months of May to September and smallest in October to January.

The mean diurnal pressure is highest in December and January. From January to February the rate of decrease is comparatively small but pressure decreases more rapidly after February, the average rate of decrease per month being about an eleventh of an inch till it attains its lowest limit in June and July, the mean pressure of these two months being the same. It then commences rising gradually during August and September, and rises rapidly from September to November. Pressure changes most rapidly from 21st September to 2nd October when it rises 0·070 inch in eleven days and again from 30th October to 10th November when the rise is almost as rapid. The rate of decrease from February to June is more uniform than that of the rise of pressure from July to December.

The absolute annual range of pressure amounts to 0·554 inch, i.e., from 30·080 inches at 10 hours on 23rd December to 29·526 inches at 16 hours on the 17th, 18th and 19th July.

The absolute range of pressure for each month is as follows:—

MONTHS.			Highest Reading at 10 hours.	Date of occurrence.	Lowest Reading at 16 hours.	Date of occurrence.	Range.
January	...	...	30·076	1st.	29·918	31st	0·158
February	...	...	30·044	„	29·865	28th	0·179
March	...	...	29·992	„	29·772	31st	0·220
April	...	...	29·896	„	29·684	30th	0·212
May	...	...	29·800	„	29·566	31st	0·234
June	...	...	29·672	„	29·529	15th-18th	0·143
July	...	...	29·647	31st	29·526	17th-19th	0·121
August	...	...	29·718	„	29·547	1st	0·171
September	...	...	29·811	„	29·610	„	0·201
October	...	...	29·924	„	29·704	„	0·220
November	...	...	30·031	„	29·822	„	0·209
December	...	...	30·060	23rd	29·922	„	0·158

The month with the greatest monthly range of pressure is May. It is followed by the months of October, March, and April. The range of pressure is smallest in the month of July, the annual transition period when pressure reaches its lowest point and commences to rise again. The periods of highest and lowest pressure roughly approximate to the winter and summer solstices, and at both periods pressure remains more or less stationary for a time, oscillating backwards and forwards about the points of maximum and minimum pressure. From about the 21st December to the 12th January and again from about the 17th June to the 19th July pressure may be said to be steady, the changes from day to day being small and irregular in character.

Pressure conditions resemble each other most closely in the months of December and January and again in June and July, as will be seen from the following figures. The months most nearly alike are June and July when the monthly mean pressure conditions may be said to be identical.

MONTHS.	1st MIN.		1st MAX.		2nd MIN.		2nd MAX.		Mean.	Amplitude of day oscillation.	Amplitude of night oscillation.	Ratio.
	4 hours Reading.	Variation from Mean.	10 hours Reading.	Variation from Mean.	16 hours Reading.	Variation from Mean.	22 hours Reading.	Variation from Mean.				
December	29.963	-0.036	30.061	+0.062	29.945	-0.054	30.025	+0.026	29.999	0.116	0.062	1.9
January	29.967	-0.037	30.063	+0.066	29.940	-0.054	30.016	+0.022	29.994	0.123	0.059	2.1
June	29.871	-0.023	29.838	+0.044	29.541	-0.053	29.625	+0.031	29.594	0.097	0.054	1.8
July	29.568	-0.024	29.635	+0.043	29.539	-0.053	29.624	+0.032	29.592	0.096	0.056	1.7

The following particulars, taken chiefly from the Annual Reports published by the late Mr. A. V. Nursingrow, may prove of interest.

The greatest range of pressure in one month occurred in November, 1870. The highest reading was 30.094 inches on the 20th and the lowest 28.697 inches taken at 3-30 A.M. on the 5th during the cyclone that visited Vizagapatam that month. The range was thus 1.397 inches.

The smallest monthly range occurred in December, 1879. The highest reading of the month was 30.029 inches on the 2nd and the lowest 29.806 inches on the 10th, the range of pressure for the month thus being only 0.223 inch.

The highest pressure ever recorded during the past twenty-six years was 30.195 inches at 10 A.M. on the 23rd January, 1885.

The lowest was 28.697 inches recorded during the cyclone of November, 1870, at 3-30 A.M. on the 5th.

Another low reading was 28.832 inches taken at 3 A.M. on the 8th, during the cyclone of October, 1876.

The absolute range of pressure during the past twenty-six years was therefore 1.498 inches.

The mean monthly pressure of the month varied most largely from the normal mean monthly pressure in the months of November and December, 1878. These months were marked by an extraordinary deficiency of pressure over the whole of the Indian region. The deficiency at Vizagapatam amounted to 0.094 inch in November and 0.101 inch in December.

**Temperature.**—The following is a list of the thermometers in use during the years 1870–95.

*Ordinary Dry Bulb.*

No.	Maker.	Used from
?	Negretti and Zambra.	1870 to 31st March, 1887.
51221	Do.	1st April, 1887.
91690	Casella.	17th September, 1894.

*Dry Maximum.*

Up to 18th April, 1888, no maximum thermometer was in use but the ordinary dry bulb readings at 2-30 p.m. were taken as showing the maximum temperature of the day. These readings have all been rejected in computing the normals given in this paper as, in addition to the uncertainty introduced by the use of an ordinary thermometer at a fixed hour every day, the exact correction for the old dry bulb is not known; and a comparison made between the "maximum" temperatures given by the ordinary dry bulb from 1870 to April, 1888, and those registered by proper maximum thermometers from April, 1888, shows that the former figures are not very reliable. From the traces furnished by the thermograph now in use it would appear that 2-30 p.m. is not the hour at which the maximum temperature is usually registered at Vizagapatam. The correct time would appear to be about two hours earlier.

From April, 1888, a proper maximum thermometer was introduced but there have been frequent changes of instruments, no less than six different thermometers having been in use during the seven years 1888–95. The following is a list of them:—

No.	Maker.	Used from
9819	Negretti and Zambra.	19th April, 1888.
9059	?	24th July, 1888.
62413	Negretti and Zambra.	1st September, 1889.
75271	Do.	4th May, 1894.
62413	Do.	1st October, 1894.
75271	Do.	1st November, 1894.

*Dry Minimum.*

Up to 18th April, 1888, the readings of the ordinary dry bulb just before sunrise were taken as the minimum temperature of the day. These observations do not appear very reliable and have all been re-

jected for reasons similar to those given for the rejection of the maximum temperatures of the same period. The following minimum thermometers have been in use since April, 1888.

No.	Maker.	Used from
69019	Casella.	19th April, 1888.
63983	Negretti and Zambra.	1st September, 1889.
84055	Casella.	6th May, 1895.

Minimum thermometer No. 63933 met with an accident and until the new instrument No. 84055 was received the ordinary dry bulb No. 91690 by Casella was read before sunrise and its readings taken as the minimum temperature of the day. No. 91690 was used in this way from 18th April to 5th May, 1895.

*Ordinary Wet Bulb.*

No.	Maker.	Used from
233	Negretti and Zambra.	1870
51222	Do.	1st April, 1887.

*Wet Minimum.*

No.	Maker.	Used from
2224	Solomons and Co.	1870 (P)
91305	Casella.	29th May, 1895.

It is not clear from the records when thermometer No. 2224 was first brought into use. It would appear from the list supplied by the Calcutta Meteorological Office that it was in use from 1870, but from the fact that many of the wet minimum readings given in the old Registers are considerably higher than those of the ordinary wet bulb at 4 A.M. it seems likely that the wet minimum readings were for some time those of the ordinary wet bulb just before sunrise.

*Solar Radiation Thermometer.*

Though readings of this instrument have been recorded for the whole period of twenty-six years they have all had to be rejected as the



instrument has always been read incorrectly, a curious mistake having been made by which the reading at the break of the mercurial column was taken instead of the maximum indicated. The readings were all about 40° too low.

*Grass Radiation Thermometer.*

No.	Maker.	Used from
3233	P	1st January, 1878.
60687	Negretti and Zambra.	23rd November, 1887.

Readings of thermometer No. 3233 are recorded in the registers from March, 1871, but some mistake was made in reading this instrument also, absurdly low readings such as 16°, and 9° being recorded for years. All observations prior to 1st January, 1878, have hence been rejected.

**Air Temperature.**—The conditions of exposure during the past 26 years in the case of the ordinary wet and dry bulb, the maximum and wet and dry minimum thermometers were not satisfactory. Until the observatory was made over to the Government of India the thermometers were suspended on the wall of Rani Atchayyama's drawing-room. The temperatures recorded under these conditions are therefore not comparable with observations taken at other stations in India in open air sheds. To render them fairly comparable it has been necessary to apply corrections to all readings, the correction for each instrument for each hour of observation during the different months of the year having been obtained by a series of daily comparative readings taken for two years of the set of thermometers in the drawing-room and of another set exposed in an open air shed constructed in 1895, after the pattern of those used in observatories in Northern India.

The figures given in the tables at the end have all had these corrections applied and it is believed they represent fairly accurately the normal temperature conditions of Vizagapatam in a form that will render them comparable with those of other Indian stations.

Plate IV gives the curves showing the diurnal changes of the mean temperature of each month and also the monthly changes of temperature during the year.

The curves have been drawn from the figures given in the following table :—

Month.	Mean tem- perature for whole day.	4 Hours.	Var. from mean of day.	10 Hours.	Var. from mean of day.	16 Hours.	Var. from mean of day.	22 Hours.	Var. from mean of day.	Max.	Var. from mean of day.	Min.	Var. from mean of day.	Mean daily range of temperature.
January	70.6	64.2	-6.4	77.9	+7.3	78.9	+8.3	69.6	-1.0	82.3	+11.7	60.6	-10.0	21.7
February	75.2	69.0	-6.2	81.5	+6.3	82.2	+7.0	74.2	-1.0	88.9	+10.7	66.4	-8.8	19.5
March	80.2	74.9	-5.3	85.7	+5.5	86.3	+5.1	79.1	-1.1	90.1	+9.9	72.6	-7.6	17.5
April	84.3	79.5	-4.8	89.4	+5.1	87.8	+3.5	82.0	-2.8	93.5	+9.2	78.0	-6.3	15.5
May	86.9	82.4	-4.5	90.7	+3.8	89.7	+2.8	84.3	-2.6	95.4	+8.5	81.2	-5.7	14.2
June	86.0	82.1	-3.9	89.0	+3.0	88.9	+2.9	83.8	-2.2	93.9	+7.9	80.6	-5.4	13.3
July	88.6	79.4	-4.2	85.6	+2.0	86.8	+3.2	81.5	-2.1	90.8	+7.2	78.3	-5.3	12.5
August	83.3	79.5	-3.8	85.8	+2.5	86.6	+3.3	81.7	-1.6	90.7	+7.4	78.0	-5.3	12.7
September	83.6	78.5	-4.1	85.6	+3.0	86.1	+3.5	80.7	-1.9	90.2	+7.6	77.0	-5.6	13.2
October	80.0	75.2	-4.8	85.2	+5.2	84.8	+4.8	78.2	-1.8	89.1	+9.1	78.0	-7.0	16.1
November	75.5	70.8	-4.7	81.0	+5.5	80.8	+5.3	74.2	-1.2	84.8	+9.3	68.1	-7.4	16.7
December	71.3	65.7	-5.6	77.6	+6.3	77.9	+6.6	70.3	-1.0	81.8	+10.5	62.8	-8.5	19.0
Mean for the year ...	80.0	75.1	-4.9	84.6	+4.6	84.7	+4.7	78.3	-1.7	89.0	+9.0	73.0	-7.0	16.0

The mean temperature of the day is computed by the formula  $\frac{2 \text{ min.} + \text{max.} + 16 \text{ hours}}{4}$ , which, it is found, gives the closest approximation

to the mean temperature of the day as deduced from the hourly readings traced by the self-registering thermograph. The times of occurrence of the maximum and minimum temperatures shown in the curves in Plate IV are also those determined by this instrument.

The mean diurnal range of temperature is greatest in the cold weather months of December, January and February. The range in January amounts to  $21^{\circ}7$ . The difference between the day and night temperatures is least in the rainy weather months, especially in July and August, when the daily range of temperatures is only  $12\frac{1}{2}^{\circ}$ .

Plate IV shows the variations of temperature for each of the twelve months of the year. The following table gives the same for the various seasons of the year.

Months.	4 H.	10 H.	16 H.	22 H.	Max.	Min.
<b>Cold Season</b> —December, January and February ...	-6.1	+6.6	+7.3	-1.0	+11.0	-9.1
<b>Hot Season</b> —March, April and May ...	-4.9	+4.8	+3.8	-2.0	+9.2	-6.5
<b>S. W. Monsoon Period</b> —June to September ...	-4.0	+2.6	+3.2	-2.0	+7.5	-5.4
<b>N. E. Monsoon Period</b> —October and November ...	-4.8	+5.4	+5.1	-1.5	+9.2	-7.2

The months of the south-west monsoon period have the most equable temperature with the smallest departures from the mean of the day. The variations are smaller than during the north-east monsoon months of October and November.

The absolute range of temperature for each month of the year is as follows :—

MONTHS.			Highest temperature.	Lowest temperature.	Absolute range.
January	...	...	83.8	59.2	24.6
February	...	...	88.1	68.7	24.4
March	...	...	92.6	69.1	23.5

M O N T H S .			Highest. temperature.	Lowest temperature.	Absolute Range.
April	...	...	94·5	76·0	18·5
May	...	...	96·2	80·1	16·1
June	...	...	95·4	79·2	16·2
July	...	...	92·5	77·9	14·6
August	...	...	91·0	77·2	13·8
September	...	...	90·5	76·1	14·4
October	...	...	90·6	70·5	20·1
November	...	...	87·1	65·9	21·2
December	...	...	83·0	61·1	21·9

The highest temperatures of the year are usually registered during the last week in May. The lowest temperatures occur generally in the second week of January. The absolute mean range of the whole year is 37°.

The mean temperature of the month varies from 86·9 in May to 70·6 in January. The mean temperature for the whole year is 80·0.

The temperature at 22 hours throughout the year is nearest the mean temperature of the day. The temperature recorded at 10 and 16 hours approximate very closely to each other, the latter being slightly higher than the former in the months of January, February, July, August, September and December and slightly lower during the remaining six months. The mean temperature at 10 hours for the whole year is practically the same as that at 16 hours, the former being 84·6 and the latter 84·7.

A table at the end gives the normal temperatures for each day of the year. The following figures give the mean daily temperatures at the beginning and end of each month, from which can be seen the changes that take place during the year and the rate of change per month.

M O N T H S .			First day of month.	Last day of month.	Change during month.
January	...	...	70·1	72·8	+2·7
February	...	...	72·9	77·4	+4·5
March	...	...	77·7	82·8	+5·1

MONTHS.			First day of month.	Last day of month.	Change during month.
April	...	...	82·9	85·8	+2·9
May	...	...	85·8	87·4	+1·6
June	...	...	87·4	84·8	-2·6
July	...	...	84·6	83·6	-1·0
August	...	...	83·6	82·6	-1·0
September	...	...	82·6	82·2	-0·4
October	...	...	83·1	77·8	-4·3
November	...	...	77·7	78·4	-4·3
December	...	...	78·2	70·2	-8·0

Temperature increases slowly during January but the rate of increase is much larger during the next two months of February and March, when temperature changes more rapidly than during any other month of the year. The increase in temperature continues during April and May but during May it is very small. From June temperature commences to decrease but the monthly changes are again very small, especially in July, August and September. In September temperature is practically the same during the whole month, for the difference between the 1st and 30th September does not amount to even half a degree. During the last three months of the year temperature decreases fairly rapidly. The changes are hence greatest just before and just after January, the month of minimum temperature, but it will be seen that the changes are not large in any month, and during the greater portion of the year temperature is nearly stationary. During the first few days of February and again in the middle of March temperature rises most rapidly, for it then rises at the rate of two-tenths of a degree a day. There is no marked fall of temperature in the middle of June due to the commencement of the south-west monsoon, such as might have been expected. The rate of decrease throughout June is very gradual and uniform. During the last few days of November and the first few days of December the fall of temperature is most rapid, the daily change being about the same as during the first few days of February.

The extreme range of mean daily temperature is from 70·1 on the first of January to 87·7 on the 24th-27th May, a difference of only 17°·6.

The following table gives the monthly changes in the maximum and minimum temperature of the day:—

MAXIMUM.				MINIMUM.			
Months.	First day of month.	Last day of month.	Change.	Months.	First day of month.	Last day of month.	Change.
January ...	80·9	83·8	+ 2·9	January ...	60·9	63·5	+ 2·6
February ...	83·9	88·1	+ 4·2	February ...	63·7	68·7	+ 5·0
March ...	88·2	92·6	+ 4·4	March ...	69·1	75·8	+ 6·7
April ...	92·7	94·5	+ 1·8	April ...	76·0	80·0	+ 4·0
May ...	94·5	95·4	+ 0·9	May ...	80·1	82·1	+ 2·0
June ...	95·4	92·8	- 2·6	June ...	82·1	79·2	- 2·9
July ...	92·5	90·4	- 2·1	July ...	79·0	78·5	- 0·5
August ...	90·3	90·3	0	August ...	78·4	77·2	- 1·2
September...	90·2	90·5	+ 0·3	September...	77·2	76·1	- 1·1
October ...	90·5	87·8	- 3·2	October ...	76·0	70·5	- 5·5
November...	87·1	83·0	- 4·1	November ...	70·4	65·9	- 4·5
December ...	83·0	80·9	- 2·1	December ...	65·6	61·1	- 4·5

The minimum temperatures show the most rapid changes. From 1st February to 31st March they rise by 11·7° and in October they fall by 5·5°. The month in which the change is greatest is March when it amounts to +6·7°.

The extreme range, during the year, of the maximum temperature is from 80·9° on the 31st December and 1st-4th January to 96·2° on the 23rd to 25th May; or 15·3°. That of the minimum temperature is from 59·2° on the 11th-15th January to 82·3° on the 27th-28th May; or 23·1°.

The range of the minimum temperature is hence considerably larger than that of the maximum.

The mean temperature of the coldest day (9th January) is 69·5°, which is 10·5° below the mean temperature of the year. The mean temperature of the hottest days (24th-27th May) is 87·7°, i.e., 7·7° above the annual mean. Temperature is above the annual mean for 213 days in the year, i.e., from 16th March to 14th October, and is on 152 days below it.

The old registers show the following temperatures which are the most remarkable ones recorded during the past 28 years. On the 11th May, 1872, a maximum temperature of 103·5° was attained under the old conditions of exposure, which would be equal to about 112° in the open-

air shed. On the 17th May, 1896, temperature rose to  $109\cdot3^{\circ}$  in the shed. The lowest temperature registered in the house was  $59\cdot4^{\circ}$ , during the night of the 28th–29th December, 1888, equal to about  $49^{\circ}$  in the shed.

The temperature of Vizagapatam hence does not undergo great changes during the year. Between the lowest minimum temperature of  $59^{\circ}$  and the highest maximum temperature of  $96^{\circ}$  there is a difference of only  $37^{\circ}$ . It must however be remembered that the temperatures quoted are means, and that temperatures lower than  $59^{\circ}$  and certainly higher than  $96^{\circ}$  are registered every year.

The departures of the maximum and minimum from the mean of the day are smallest during the months of June, July, August and September, when they average only  $7\cdot5^{\circ}$  during the day and  $5\cdot4^{\circ}$  during the night. Temperature conditions are strikingly similar during July and August and may be pronounced practically identical. The following figures, taken from the table given at the commencement of this section, will illustrate this :—

				July.	August.
Mean temperature of day	...			83·6	83·3
Temperature at 4 hours	...			79·4	79·5
"    "    10    "	..			85·6	85·8
"    "    16    "	...			86·8	86·6
"    "    22    "	...			81·5	81·7
Maximum temperature	...			90·8	90·7
Minimum	...	...	..	78·8	78·0
Daily range	...	...	...	12·5	12·7

The largest and most rapid changes of temperature occur during thunderstorms in the months of April and May. In Part I of this paper reproductions of thermograph traces are given in which a fall of  $10^{\circ}$  or  $15^{\circ}$  in as many minutes is shown to be not uncommon. The traces of the thermograph also show that temperature is often very unsteady during fine weather, comparatively large and sudden oscillations taking place which are probably in most cases due to passing clouds obscuring the sun.

The establishment of an observatory on the Sandhills in the neighbouring station of Waltair has afforded the means of comparing the temperature conditions of Waltair with those of Vizagapatam. The differences in temperature are considerable, as will be seen from the following table giving the average observed differences of temperature at 8 A.M. and of the maximum and minimum of the day, for eleven months in 1897 and ten months in 1898.

1897.

1898.

	Dry Bulb.			Max.			Dry Min.			Dry Bulb.			Max.			Dry Min.		
	Vizag.	Walt.	Diff.	Vizag.	Walt.	Diff.	Vizag.	Walt.	Diff.	Vizag.	Walt.	Diff.	Vizag.	Walt.	Diff.	Vizag.	Walt.	Diff.
January	76.8	?	?	67.5	?	?	72.4	70.7	-1.7	81.5	79.7	-1.8	60.4	65.5	+5.1	60.4	65.5	+5.1
February	81.6	78.4	-3.2	73.5	74.4	+0.9	75.8	78.6	-2.2	84.0	82.0	-2.0	64.4	68.6	+4.2	64.4	68.6	+4.2
March	82.8	80.1	-2.7	75.7	75.9	+0.2	81.9	79.0	-2.9	91.1	87.3	-3.8	71.7	73.9	+2.2	71.7	73.9	+2.2
April	86.1	83.8	-2.3	79.1	78.8	-0.3	84.9	82.6	-2.3	92.7	88.7	-4.0	78.9	78.1	-0.8	78.9	78.1	-0.8
May	87.9	86.5	-1.4	82.2	81.2	-1.0	87.7	86.4	-1.3	94.8	91.8	-3.0	81.8	81.1	-0.7	81.8	81.1	-0.7
June	88.7	87.0	-1.7	88.4	82.5	-0.9	85.8	83.5	-2.3	92.9	90.7	-2.2	80.6	79.8	-0.8	80.6	79.8	-0.8
July	85.4	82.6	-2.8	80.2	79.2	-1.0	83.9	83.1	-1.8	89.9	88.8	-1.1	79.4	76.7	-0.7	79.4	76.7	-0.7
August	84.9	82.0	-2.9	79.4	78.4	-1.0	84.2	83.0	-1.2	92.2	90.9	-1.3	79.3	78.7	-0.6	79.3	78.7	-0.6
September	82.7	80.8	-1.9	77.7	77.3	-0.4	83.1	82.5	-0.6	89.6	88.9	-0.7	77.7	78.0	+0.3	77.7	78.0	+0.3
October	82.2	81.5	-0.7	76.7	77.4	+1.7	82.1	82.5	+0.4	88.7	88.2	-0.5	76.8	76.9	+1.1	76.8	76.9	+1.1
November	77.7	77.5	-0.2	69.8	72.5	+2.7												
December	73.2	72.6	-0.6	62.7	67.3	+4.6												



The probable causes of these differences in temperature will be found discussed in the annual report of the observatory for 1897.

**Nocturnal Radiation.** As has already been mentioned the observations recorded of the grass minimum thermometer from 1871 to the end of 1877 have had to be rejected. The normals given in the table at the end are therefore based on only 18 years' observations (1878-95).

The thermometer was formerly exposed on a wooden stand about four inches high in a small grass plot surrounded by walls. Owing to the walls and a number of large shrubs the conditions of exposure were not of the very best, and readings of another thermometer exposed in the observatory grounds under proper conditions showed differences which were not only often large but were also very irregular, the difference varying for instance from  $4.9^{\circ}$  one day to  $0.5^{\circ}$  a few days afterwards.

The figures given in the table at the end are the smoothed means of the past 18 years with corrections applied, the corrections being ascertained from comparative readings of instruments under the old and new conditions of exposure, taken for a period of two years.

The depression of the grass thermometer below the dry minimum in the shade is not great at any time of the year, and during the greater portion of the year it is very small. The difference is largest from 21st January to 20th March when it ranges from  $5^{\circ}$  to  $6.6^{\circ}$ . The difference again exceeds  $5^{\circ}$  from 21st November to 8th December and from 21st to 25th December, but during the rainy weather months of July, August, September and October the depression does not amount to as much as  $3^{\circ}$ , and from 24th August to 10th September and again from 13th to 21st October it is below  $2^{\circ}$ .

The following table shows how radiation at night varies with (1) the amount of cloud, and (2) with the dampness of the air. Means are given of the cloud and relative humidity at 4 and 22 hours for each month.

MONTHS.			Depression of grass thermo- meter below thermometer in shade.	Cloud.	Relative Humidity.
January	...	...	4.8	1.60	86.0
February	...	...	6.1	1.55	83.5
March	...	...	5.0	2.15	81.5
April	...	...	3.3	3.15	81.0

MONTHS.			Depression of grass thermo- meter below thermometer in shade.	Cloud.	Relative Humidity.
May	...	...	3.5	4.65	80.0
June	...	...	2.8	6.00	79.5
July	...	...	2.8	6.75	88.5
August	...	...	2.7	6.45	84.0
September	...	...	2.0	5.60	88.5
October	...	...	2.1	4.55	89.0
November	...	...	4.1	3.10	83.5
December	...	...	5.0	2.20	81.0

The amount of cloud thus affects the readings of the grass thermometer most, as might have been expected, but the humidity of the air also affects them to a considerable extent. June, July and August, the cloudiest months of the year, are not the months in which radiation is least. The difference between the grass and shade thermometers is smallest in September and October when the cloud amount is less but the air is much damper. Relative humidity is greater during these two months than in any other month of the year, and the small amount of radiation that takes place during these months is doubtless largely attributable to this fact. There is again almost the same amount of cloud in January and February, but in February the air is drier and hence the depression of the grass thermometer is greater.

There is a noticeable increase in radiation during the month of August. The amount of cloud is almost the same as in July, but since relative humidity is practically the same, being only 0.5 per cent. more, the increase is presumably due almost entirely to the small decrease of 0.30 in cloud. The ratio of increase of radiation to decrease in cloud is the same as that shown in the months of March and April, another pair of months in which relative humidity remained the same while only the proportion of cloud altered.

**Humidity.**—The observations taken at 4, 10, 16 and 22 hours do not serve to show the maxima and minima of vapour pressure and relative humidity as these depend on the readings of the wet and dry thermometers, the highest and lowest of which do not occur at the hours named. The curves in Plates V and VI hence do not give the extremes of either element and the more pronounced characteristics of each curve are lost. This would appear to be especially the case with vapour

pressure as the daily double oscillation generally noticeable when hourly observations are dealt with is, except in a few months, indistinguishable.

*Vapour Pressure.*—During the cold weather months of December, January, and February, vapour pressure is at its minimum in the early morning, as shown by the 4 A.M. observations. As the hot weather advances the tendency shown is for the minimum to occur later in the day, and in April and May there is a well defined minimum occurring at 10 A.M. In June the minimum continues to occur at 10 A.M., but the variations of vapour pressure from the mean of the day are during the rainy season very small in amount, there being but little change during the whole twenty-four hours. From July the minimum again is recorded at 4 A.M. and continues so during the next three months. In November vapour pressure at 10 A.M. is lower than at 4 A.M., but from December the well marked early morning minimum again makes its appearance. During the months of January, July and September there are traces of a second minimum at 4 P.M., but it is only in July and September that it is at all clearly defined. Even in these months the fall from 10 A.M. is very small in amount, being only from five to seven thousandths of an inch.

The maximum generally occurs at 10 P.M.; and from November on to April the variation from the mean of the day at this hour exceeds .016 inch in amount. The maximum in February, March and April is .023, .026, and .025 inch above the mean of the day. The only month in which the maximum does not occur at 10 P.M. is in July, when vapour pressure is .001 inch higher at 10 A.M. A second maximum occurs in January, July and September.

The diurnal changes in vapour pressure are largest in December, January, February, March and April, when vapour pressure falls from 10 P.M. to 4 A.M. and rises from 10 A.M. to 4 P.M. by the following amounts.

MONTHS.		10 P.M.	4 A.M.	Difference.	10 A.M.	4 P.M.	Difference.
December ...	...	·578	·533	—·045	·555	·567	+·012
January ...	..	·592	·542	—·050	·582	·582	0
February ...	...	·669	·621	—·048	·645	·650	+·005
March ...	...	·774	·737	—·037	·728	·753	+·025
April ...	...	·867	·836	—·031	·813	·850	+·027

There is thus in the majority of months only one clearly marked oscillation, the most rapid change during which generally occurs at night between the hours of 10 P.M. and 4 A.M.

The changes in vapour pressure during the rainy season months are very small, the mean daily range in these months being as follows:—

				Inch.
June	...	...	...	·016
July	...	...	...	·019
August	...	...	...	·018
September	...	...	...	·016
October	...	...	...	·026

The curve at the foot of Plate V gives the changes in mean monthly vapour pressure during the year. Roughly speaking the changes in vapour pressure are opposite in character to those of atmospheric pressure. The latter is highest in the cold weather and lowest in the rains: vapour pressure is lowest in the cold weather and highest from May to September.

From the table at the end giving the normal vapour pressure for each day of the year, it will be seen that vapour pressure is lowest from the 23rd to 26th December when the mean of the day amounts to only ·537 and ·538 inch. The rise is most rapid in March when it rises from ·677 inch on 28th February to ·804 inch on 31st March, or an increase of ·127 inch in the month. It attains its maximum of ·937 inch on the 27th and 28th May. After falling slightly during the first few days of June, it remains practically stationary during the remainder of the month of June and during the months of July, August and September, rising slightly to a second maximum of ·899 inch on the 15th and 16th September, and then commencing to decrease. The decrease to its minimum in December is much more rapid than its increase at the beginning of the year. In October vapour pressure decreases by ·131 inch and in November by ·152 inch. The annual range in vapour pressure (taking daily means) is from ·937 inch in May to ·537 in December; or ·400 inch. The absolute range is from ·945 inch at 4 P.M. on 27th to 29th May to ·508 inch at 4 A.M. on 27th December; or ·437 inch.

The remarkably large and rapid changes in vapour pressure occurring during nor-westers in the hot weather will be found described in Part I of this paper.

The following are a few of the more remarkable vapour pressures recorded since 1st August, 1895.

Date.				
9th December, 1895	...	...	...	·239 inch.
10th do. "	...	...	...	·214 "
20th February, 1896	...	...	...	·276 "
20th May, 1896	...	...	...	1·129 inches.
9th do. 1898	...	...	...	1·116 "
10th do. "	...	...	...	1·114 "

The figures giving vapour pressure and relative humidity shown in the old registers previous to 1st August, 1895, have all been rejected as they were based on readings of the thermometer, vitiated by instrumental and other errors. The normals given in the tables in this paper have been calculated from the corrected and smoothed normals of the dry and wet bulb thermometers with the help of the tables published by the Indian Meteorological Department.

The following table gives the mean vapour pressure at 4, 10, 16 and 22 hours of each month and the variations from the mean of the four observations. The curves in Plate V have been drawn from these figures.

MONTHS.		Mean.	4 Hours.		10 Hours.		16 Hours.		22 Hours.	
January	...	·575	·542	-·033	·582	+·007	·582	+·007	·592	+·017
February	...	·646	·621	-·025	·645	-·001	·650	+·004	·669	+·023
March	...	·748	·737	-·011	·728	-·020	·753	+·005	·774	+·026
April	...	·842	·836	-·006	·813	-·029	·850	+·008	·867	+·025
May	...	·913	·909	-·004	·898	-·015	·920	+·007	·926	+·013
June	...	·891	·888	-·003	·885	-·006	·889	-·002	·901	+·010
July	...	·869	·855	-·014	·875	+·006	·870	+·001	·874	+·005
August	...	·883	·870	-·013	·887	+·004	·888	+·005	·888	+·005
September	...	·893	·887	-·006	·895	+·002	·888	-·005	·903	+·010
October	...	·821	·805	-·016	·824	+·003	·825	+·004	·831	+·010
November	...	·664	·654	-·010	·646	-·018	·673	+·009	·682	+·018
December	...	·558	·533	-·025	·555	-·003	·567	+·009	·578	+·020

*Relative Humidity.*—The following table, from which the curves in Plate VI have been drawn, gives the same data for relative humidity :—

Months.	Mean.	4 Hours.		10 Hours.		16 Hours.		22 Hours.	
January ...	73	90	+17	61	-12	58	-15	82	+9
February ...	72	88	+16	60	-12	59	-13	79	+7
March ...	71	85	+14	59	-13	61	-10	78	+7
April ...	71	83	+12	58	-13	65	-6	79	+8
May ...	72	82	+10	62	-10	66	-6	78	+6
June ...	72	81	+9	65	-7	65	-7	78	+6
July ...	77	85	+8	71	-6	68	-9	82	+5
August ...	78	86	+8	72	-6	70	-8	82	+4
September ...	80	91	+11	73	-7	71	-9	86	+6
October ...	79	92	+13	67	-12	69	-10	86	+7
November ...	73	87	+14	61	-12	64	-9	80	+7
December ...	70	84	+14	58	-12	59	-11	78	+8

The table at the end gives the normal relative humidity for each day of the year.

The changes in relative humidity during the year are not large, the climate of Vizagapatam being a uniformly damp one. The percentage of humidity falls below 60, during the day, after the monsoon has retreated to the south of the Bay in November, and until the approaching monsoon makes itself felt in May, but the nights are damp throughout the year, the lowest percentage of the two night observations being 76.

The maximum relative humidity occurs always at 4 A.M. and even during December, the driest month of the year, the mean humidity percentage of the month at this hour is 84. The dampest months are of course the months of heaviest rain-fall, September and October, and during these months the percentage of saturation at 4 A.M. ranges from 90 to 93, never falling below 90. There is a marked difference in the dampness of the air in the day time, in these two months. In October the 10 A.M. observations of relative humidity average 67 per cent., while in September they average 73. The 4 P.M. percentages in October are

also lower than those of September but the differences are much smaller. It hence follows that though the rain-fall in October is heavier than in September, the air is drier in October in the day time than in September, the difference being most marked at 10 o'clock in the morning.

Relative humidity during the day attains its maximum in the months of July, August and September and during the night is highest in January, September and October. There is a noteworthy increase in humidity shown by the night observations during the month of January. The mean of the night observations in December is 81, in January it increases to 86, the increase being most marked at 4 A.M., and then it falls to 83.5 in February and 81.5 in March. January is hence one of the months of maximum nocturnal humidity and is surpassed in this respect by only September and October.

The annual curve given at the foot of Plate VI shows how very little the relative humidity of Vizagapatam changes during the year. The range in monthly means is only from 70 per cent. in December to 80 per cent. in September, the difference between the driest and dampest months of the year thus being only ten. The lowest percentage shown in the table of daily normals is 57 which occurs at 10 A.M. or 4 P.M. on a few days in February, March, April and December. The highest normal percentage is 93, which occurs at 4 A.M. during the second half of October.

The absolute range during the year is accordingly from 57 to 93, a difference of 36.

Humidity decreases rapidly during November, as soon as the monsoon winds have retreated too far south to affect Vizagapatam. From the 4th to the 16th November the mean daily relative humidity decreases from 77 to 71 per cent. There is a correspondingly rapid increase during the latter part of June and the first part of July, when the south-west monsoon usually commences at Vizagapatam. From 24th June to 6th July relative humidity rises from 72 to 77, an increase of 5 in twelve days.

Some remarkably low percentages are occasionally recorded during the cold and early hot weather months. The following occur in the registers since 1st August, 1895.

25	per cent.	10th December, 1895,	at 10 A. M.
26	do.	20th do.	at 10 A. M.
24	do.	27th February, 1896,	at 4 P. M.
25	do.	3rd March „	at 10 A. M.
27	do.	22nd October „	at 4 P. M.
26	do.	16th March, 1898,	at 10 A. M.

The most remarkable of these, though it is not the very lowest, is the 27 per cent. in 1896, as it occurred in October, which is usually one of the two dampest months of the year. October, 1896, was however an extremely abnormal month as the north-east monsoon failed entirely. The plates published in the annual report of that year show how largely all the meteorological conditions of the month varied from the normal.

**Cloud.**—The following table gives the mean amount of cloud for each month and the variation from the mean at each hour of observation. The amount of cloud is reckoned as usual from 0 to 10, 0 representing a clear sky and 10 a sky entirely overcast.

Months.	Mean of days.	4 Hours.		10 Hours.		16 Hours.		22 Hours.	
		Cloud.	Var. from mean.	Cloud.	Var. from mean.	Cloud.	Var. from mean.	Cloud.	Var. from mean.
January	...	1.75	1.5 -0.25	2.1	+0.35	1.7	-0.05	1.7	-0.05
February	...	1.68	1.5 -0.18	2.1	+0.42	1.5	-0.18	1.6	-0.08
March	...	2.15	2.1 -0.05	2.0	-0.15	2.3	+0.15	2.2	+0.05
April	...	3.05	3.0 -0.05	2.5	-0.55	3.4	+0.35	3.3	+0.25
May	...	4.50	4.6 +0.10	4.2	-0.30	4.5	0	4.7	+0.20
June	...	6.28	6.2 -0.08	6.4	+0.12	6.7	+0.42	5.8	-0.48
July	...	7.15	6.9 -0.25	7.5	+0.35	7.6	+0.45	6.6	-0.55
August	...	6.85	6.6 -0.25	7.1	+0.25	7.4	+0.55	6.3	-0.55
September	...	6.08	5.7 -0.33	6.4	+0.37	6.5	+0.47	5.5	-0.53
October	...	4.90	4.6 -0.30	5.2	+0.30	5.3	+0.40	4.5	-0.40
November	...	3.45	3.0 -0.45	3.3	+0.35	3.3	+0.35	3.2	-0.25
December	...	2.53	2.2 -0.33	2.9	+0.37	2.8	+0.27	2.2	-0.33
Mean of year	...	4.19	3.99 -0.20	4.35	+0.16	4.46	+0.27	3.97	-0.22

Skies are clearest during the months of January and February; cloud then increases until it attains its maximum in July. The increase from April to May, the month of maximum temperature, is almost as large as from May to June, the month in which the south-west monsoon generally commences. In August skies are almost as heavily clouded as in July, but from September the amount of cloud decreases, though September and October are the months of heaviest rainfall.



The following table gives the cloud for each of the six months of the rainy season, with the amount of the monthly rainfall and number of rainy days.

Month.	Cloud.	Rainfall.	Number of Rainy days.
June ... ..	6.28	8.51	6.78
July ... ..	7.15	4.78	9.78
August ... ..	6.85	5.69	10.81
September ... ..	6.03	8.00	10.69
October ... ..	4.90	11.19	10.77
November ... ..	3.45	4.89	4.85

Skies hence are most heavily clouded during the first few months of comparatively light rainfall, and cloud decreases as rainfall increases. October has double the rainfall of August and has at the same time nearly one-third less cloud. The rainfall of July is slightly less than that of November, but the cloud in November is less than half that in July.

The rainfall per rainy day, in the north-east monsoon is, it is true, heavier than in the south-west monsoon and there are thus proportionately fewer rainy days during the later months of the rainy season, but this is not sufficient to account for these large differences. It thus follows that during the intervals between the burst of rainfall in September, October and November skies are clearer than during similar breaks in the earlier months of the rains. During the months of June, July and August (and to a less extent in May also) skies are more or less uniformly clouded throughout the month.

Plate VII (drawn from the table given at the commencement of this section) shows the variations in the amount of cloud from the mean of the day, at each hour of observation. In the months of January and February there is more cloud at 10 A.M. than at any of the three other hours of observation. As the hot weather advances the tendency to the 10 A.M. maximum disappears. In March the variations from the mean are very small and the amount of cloud appears to be very equally distributed throughout the twenty-four hours. In April and May, the remaining months of the hot weather, the 10 A.M. observations show the least cloud, and at 4 and 10 P.M. and at 4 A.M. cloud is either equal

to or in excess of the mean of the day. From June onward to the end of the year the curves are very similar; they all show cloud in excess of the mean during the day, and in defect at night.

The following table gives the diurnal variations of cloud according to the seasons of the year.

	Mean of day.	4 A.M.	10 A.M.	4 P.M.	10 P.M.				
Cold weather period (December, January and February) ...	1.99	1.78	-0.28	2.87	+0.36	2.00	+0.01	1.83	-0.16
Hot weather period (March, April and May) ...	3.23	3.23	0	3.90	-0.33	3.40	+0.17	3.40	+0.17
South-west monsoon (June, July, August and September) ...	6.58	6.25	-0.23	6.85	+0.27	7.05	+0.47	6.05	-0.53
North-east monsoon (October and November) ...	4.18	3.80	-0.38	4.50	+0.32	4.55	+0.37	3.85	-0.33

Only during the cold season is the sky comparatively free from cloud, and most of the cloud at this time of the year occurs in the day. Cloud increases considerably during the hot season and is heaviest in the afternoon and at night. There is of course a large increase in cloud during the next four months, the south-west monsoon period, and skies at this time of the year are most heavily clouded in the day, the two day observations showing an average of 6.95, while at night the average amounts to 6.20. During the north-east monsoon period days are again more clouded than the nights and the difference between the two sets of observations is the same, though the amount of cloud is considerably less, the difference between day and night hence being relatively much greater.

The variations of each observation from the mean of the day are throughout the year very small in amount, and from the four six-hourly observations here tabulated it would appear that the amount of cloud is nearly uniform throughout the twenty-four hours. A series of hourly observations would however probably show larger differences.

**Wind.**—There are no wind observations of sufficient accuracy to form the basis of a discussion, and this will therefore have to be deferred till sufficient reliable data are furnished by the anemograph lately erected on the sand-hills in Waltair.

## CLIMATE OF VIZAGAPATAM.

The climate of Vizagapatam is, from the proximity of the sea, very uniform throughout the year. Though there are well defined seasons the climatic conditions do not present any great contrasts, the annual range of humidity and temperature, the two most important climatic elements, being comparatively small. The changes from month to month are also small.

The annual rainfall amounts to 44·09 inches, which is distributed over the greater part of the year, there being eight months in which the normal monthly rainfall exceeds one and a half inches.

The mean monthly relative humidity varies from only 70 to 80 per cent. of saturation; and absolute humidity, as shown by the mean monthly vapour pressure, from ·558 to ·913 inch. The range of monthly means for relative humidity is hence only 10 per cent. and for absolute humidity ·355 inch. The amount of cloud also fails to show any very large and striking differences during the year. In February, the clearest month, the mean daily proportion of cloud is 1·68; and in July, the month in which skies are most heavily clouded, the daily average is equal to 7·15; being a difference of only 5·47 between the clearest and cloudiest months of the year.

There is no long continued series of observations to show the amount of sunshine recorded each month, but the following table giving the average hours of sunshine per day of each month for the last two years, from May 1896 to May 1898, may be of interest.

Months.				Actual number, 1896-98.		Possible number (approx.).	
				Hrs.	Min.	Hrs.	Min.
January	...	...	...	9	30	11	10
February	...	...	...	9	10	11	30
March	...	...	...	8	45	12	0
April	...	...	...	8	9	12	25
May	...	...	...	7	25	12	50
June	...	...	...	4	49	13	5
July	...	...	...	2	45	13	0
August	...	...	...	3	15	12	40
September	...	...	...	3	59	12	10
October	...	...	...	7	26	11	40
November	...	...	...	7	22	11	15
December	...	...	...	8	18	11	0

Turning to temperature, the next element of importance in determining climate, it will be seen by a reference to the tables given in the preceding sections that the mean diurnal temperature for each month varies from  $70.6^{\circ}$  to  $86.9^{\circ}$ , a difference of only  $16.3^{\circ}$  in the year. The monthly mean maximum temperature ranges from  $81.8^{\circ}$  to  $95.4^{\circ}$ , a difference of only  $13.6^{\circ}$ , and the monthly mean minimum temperature from  $60.6^{\circ}$  to  $81.2^{\circ}$ , a difference of  $20.6^{\circ}$ . The night or minimum temperature hence shows the largest annual range. The daily range of temperature varies from  $12.5^{\circ}$  in July to  $21.7^{\circ}$  in January.

The following table gives the departures of the figures quoted above from  $80^{\circ}$ , which is the mean temperature for the whole year.

Lowest monthly mean temperature	...	...			- 9.4
Highest do. do.	...	...	...		+ 6.9
Lowest monthly maximum	...	...	...		+ 1.8
Highest do. do.	...	...	...		+15.4
Lowest monthly minimum	...	...	...		-19.4
Highest do. do.	...	...	...		+ 1.2

The year at Vizagapatam may be divided into the following seasons :

*Cold Season*—comprising the months of December, January and February.

*Hot Season*—comprising March, April and May.

*Rainy Season*—including June, July, August, September, October and November. The rains however do not generally commence till about the 10th June.

*Cold Season.*—The following figures give the chief features of the climate of Vizagapatam at this season of the year:

	December.	January.	February.	For whole season.
Mean temperature at 4 A.M.	65.7	64.2	69.0	66.3
Do. 10 A.M. ...	77.6	77.9	81.5	79.0
Do. 4 P.M. ...	77.9	78.9	82.2	79.7
Do. 10 P.M. ...	70.8	69.6	74.2	71.4

	December.	January.	February.	For whole season.
Mean maximum ...	81·8	82·3	85·9	83·3
„ minimum ...	62·8	60·6	66·4	63·3
„ temperature of the day ...	71·3	70·6	75·2	72·4
„ daily range of temperature ...	19·0	21·7	19·5	20·1
„ daily change in do. ...	-0·10	+0·09	+0·16	+0·05
Mean vapour pressure for whole day ...	0·558	0·575	0·646	0·593
Mean relative humidity for whole day ...	70	73	72	72
Mean cloud for whole day ...	2·53	1·75	1·68	1·99
Total rainfall, in inches ...	1·82	0·31	0·15	2·28
Number of rainy days ...	1·35	0·62	0·46	2·43
Frequency of rainfall (i.e., number of rainy days divided by total number of days) ...	0·04	0·02	0·02	0·03

The north-east monsoon rains cease with the final retreat southwards of the monsoon current at the end of November, and the brief cold season commences with the cessation of the rains. As will be seen from the temperature data given it is never really cold, the lowest night temperature registered during the last eleven years (1888-1898) being one of only about 49° in December, 1888. Though the driest season of the year, both absolutely and relatively, as both vapour pressure and the percentage of saturation are lower in December than at any other time, the air is nevertheless charged with moisture to a considerable extent, as the prevailing north-easterly winds blow directly from off the sea. The air is dampest at 4 A.M., especially in January, when the mean percentage of saturation for the whole month amounts to no less than 90 per cent., only two per cent. lower than in October, the month of heaviest rainfall.

Skies are never long free from cloud in Vizagapatam, but January and February are the clearest months in the year. Occasionally moderately heavy rain falls in December, due chiefly to cyclonic storms which cross the coast to the south during the period of the so-called north-east monsoon rains in Southern-India, but January and February are practically rainless.

The chief characteristics of the Vizagapatam cold season hence are comparatively clear fine weather and a larger range of temperature

than at any other season of the year. The dampness of the air deprives it of the bracing effect of the cold season in drier parts of India, and it is of very brief duration; the rapid rise of temperature in February showing the near approach of the hot season.

**Hot Season.**—The prevailing meteorological conditions during the three hot season months of March, April and May are as follow :—

	March.	April.	May.	For whole Season.
Mean temperature at 4 A.M. ...	74·9	79·5	82·4	78·9
Do. 10 A.M. ...	85·7	89·4	90·7	88·6
Do. 4 P.M. ...	85·3	87·8	89·7	87·6
Do. 10 P.M. ...	79·1	82·0	84·3	81·8
Mean maximum ...	90·1	93·5	95·4	93·0
„ minimum ...	72·6	78·0	81·2	77·3
„ temperature of the day ...	80·2	84·3	86·9	83·8
„ daily range of temperature ...	17·5	15·5	14·2	15·7
„ daily change in do. ...	+0·16	+0·10	+0·05	+0·10
Mean vapour pressure for whole day	0·748	0·842	0·913	0·834
Mean relative humidity for whole day ...	71	71	72	71
Mean cloud for whole day ...	2·15	3·05	4·50	3·23
Total rainfall in inches ...	0·40	0·75	2·65	3·80
Number of rainy days ...	0·81	0·88	3·81	5·50
Frequency of rainfall ...	0·03	0·03	0·12	0·06

Temperature rises as rapidly in March as in February. The rise is less rapid in April, but still averages a degree in every ten days. The air is drier than in January and February during the first two months of the hot season, but vapour pressure continues to increase steadily. The moist heat of Vizagapatam is mitigated by strong winds from the south-west which blow steadily all day; and by occasional thunderstorms, which occur at more frequent intervals as temperature and vapour pressure are approaching their maximum in May. But though these storms cause a large and rapid fall of temperature, their effect is but temporary, and they are usually followed by a day or two of very oppressive heat. The south-west winds fall off in strength after the storm, due probably to a decrease in the steepness of the local pressure gradients, and until they regain their normal strength the weather is very close and sultry.

The rapid increase of cloud, probably due to the rise in temperature and increase in absolute humidity, is another characteristic of the hot season in Vizagapatam. Skies are generally most heavily clouded in the afternoon and at night.

The meteorology of the month of May presents several points of interest. The difference between the day and night oscillations of pressure is more pronounced at the end of this month than at any other time of the year. From a year's record obtained from the anemograph in Waltair it would appear that the highest mean wind velocity is that registered during May. Temperature attains its maximum; and vapour pressure is also higher in May, due to the high temperature, than in any other month of the year.

**Rainy Season.**—The rainy season may be subdivided into (a) the south-west monsoon period, and (b) the north-east monsoon period, the former ending about the 4th October and the latter commencing, after a break of a few days, about the 14th October.

The following table gives a *resumé* of the climatic elements for the whole period.

	June.	July.	August.	September.	October.	November.	For whole Season.
Mean temperature at 4 A.M. ...	82.1	79.4	79.5	78.5	75.2	70.8	77.6
Do. 10 A.M. ...	89.0	85.6	85.8	85.6	85.2	81.0	85.4
Do. 4 P.M. ...	88.9	86.8	86.6	86.1	84.8	80.8	85.7
Do. 10 P.M. ...	83.8	81.5	81.7	80.7	78.2	74.3	80.0
Mean maximum ...	93.9	90.8	90.7	90.2	89.1	84.8	89.9
„ minimum ...	80.6	78.3	78.0	77.0	73.0	68.1	75.8
„ temperature of the day ...	86.0	83.6	83.3	82.6	80.0	75.5	81.8
„ daily range of temperature	13.3	12.5	12.7	13.2	16.1	16.7	14.1
„ „ change in do. ...	-0.09	-0.03	-0.03	-0.01	-0.14	-0.14	-0.07
Mean vapour pressure for whole day ...	0.891	0.869	0.883	0.893	0.821	0.664	0.837
Mean relative humidity for do.	72	77	78	80	79	73	77
Mean cloud for whole day ...	6.28	7.15	6.85	6.03	4.90	3.45	5.78
Total rainfall in inches ...	8.51	4.73	5.69	8.00	11.19	4.89	38.01
Number of rainy days ...	6.73	9.73	10.31	10.69	10.77	4.85	53.08
Frequency of rainfall ...	0.22	0.31	0.33	0.36	0.35	0.16	0.29

As the rains do not generally begin till about the 10th June, it will be found that the means which are given above for the whole month differ to a greater or less degree from those of the succeeding months. Temperature is higher and relative humidity and rainfall frequency are lower.

On the burst of the monsoon the most noticeable changes are the large increase in cloud and relative humidity, and decrease in temperature. Rainfall for the first two or three months is comparatively light; and during June, the first month, is but little heavier than during May. It is not till September, the last month of the south-west monsoon period, that heavy rain commences; and the chief characteristics of the months of June, July and August are only the increased dampness of the air, and the heavy cloud which completely obscures the sky for days together. As has already been noticed, there is more cloud during these first months of comparatively light rainfall than during the later months of much heavier rainfall. After June, when temperature decreases at the rate of  $0.08^{\circ}$  a day, there is very little change in temperature till October. During the months of July, August and September temperature is practically uniform, the difference between the mean temperature of July and that of September being only  $1^{\circ}$ . The daily range of temperature during these months is the smallest during the year, as there is only about  $12^{\circ}$  or  $13^{\circ}$  difference between the day maximum and the night minimum.

Owing to the general cooling of the heated land surface, the south-westerly breeze which is so important a factor in mitigating the heat of the hot weather months falls off greatly in strength during the rains; and though the temperature is less than in May the weather is often most oppressively close and steamy. The nights are particularly trying in this respect. The occasional showers of rain received have only a temporary effect in lowering temperature. As these showers still further raise the already high percentage of saturation, the weather is often more oppressive shortly after them than during the breaks of fine but cloudy weather which intervene.

Rainfall is slightly heavier in August but it is not till September, the last month of the south-west monsoon, that really heavy rain commences. September is the dampest month of the year and it is considered the most trying, but from October a change is perceptible. Rainfall continues to be heavy, for more rain falls in October than in any other month, but temperature begins to decrease rapidly and skies commence to clear; the breaks between the bursts of rainfall being, it is true, less frequent but more complete, as the dense cloud which has



covered the sky during the preceding four months is not so persistent, and fine clear weather alternates with rainfall. In November temperature continues to fall rapidly and rainfall diminishes both in quantity and frequency. The decrease in humidity is large and striking, the fall in vapour pressure being particularly remarkable, as from .821 inch in October it decreases to .664 inch in November.

The distinguishing features of the north-east monsoon period as compared with the south-west monsoon are (1) heavier rainfall, (2) less cloud, (3) lower temperature, especially at night, by which the daily range is increased, and (4) decrease in both vapour pressure and relative humidity.

Cyclonic storms occur throughout the whole of the monsoon period, but as they form near the head of the Bay in June, July and August they do not affect Vizagapatam to any great extent in those months, beyond causing occasional heavy down-pours of rain. It is in September, October and November that the greatest number of storms affect Vizagapatam; and as it is during these months that the severer storms of this class are generated, many of the storms that cross the coast near Vizagapatam are of considerable intensity.

The monsoon rainfall practically ceases in November, and in December the short cold season of Vizagapatam sets in.

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**Tables giving the Normal Pressure, Temperature,  
Humidity and Cloud at Vizagapatam  
for each day of the year.**

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## PRESSURE.

JANUARY.

DATE.			4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Amplitude of day of oscillation.	Amplitude of night of oscillation.	Ratio.
			29 +	29 +	29 +	29 +	29 +			
1	...	...	'974	1'076	'956	1'083	1'010	'120	'059	2'03
2	...	...	'973	1'075	'955	1'082	1'009	'121	'059	2'03
3	...	...	'972	1'075	'954	1'081	1'008	'121	'059	2'05
4	...	...	'971	1'074	'953	1'080	1'007	'121	'059	2'05
5	...	...	'970	1'073	'952	1'028	1'006	'121	'058	2'09
6	...	...	'968	1'072	'951	1'026	1'004	'121	'058	2'09
7	...	...	'966	1'071	'950	1'025	1'003	'121	'059	2'05
8	...	...	'966	1'071	'950	1'025	1'003	'121	'059	2'05
9	...	...	'965	1'070	'949	1'024	1'002	'121	'059	2'05
10	...	...	'964	1'069	'948	1'024	1'001	'121	'060	2'02
11	...	...	'964	1'069	'947	1'024	1'001	'122	'060	2'03
12	...	...	'963	1'068	'947	1'023	1'000	'121	'060	2'02
13	...	...	'961	1'068	'945	1'022	'999	'123	'061	2'02
14	...	...	'960	1'066	'944	1'021	'998	'122	'061	2'00
15	...	...	'959	1'065	'942	1'019	'996	'123	'061	2'02
16	...	...	'957	1'064	'941	1'018	'995	'123	'061	2'02
17	...	...	'955	1'063	'939	1'016	'993	'124	'061	2'03
18	...	...	'954	1'061	'938	1'015	'992	'123	'061	2'02
19	...	...	'952	1'060	'936	1'013	'990	'124	'061	2'03
20	...	...	'951	1'059	'935	1'013	'990	'124	'062	2'00
21	...	...	'951	1'059	'934	1'012	'989	'125	'061	2'05
22	...	...	'950	1'058	'933	1'012	'988	'125	'062	2'02
23	...	...	'950	1'058	'932	1'010	'988	'126	'060	2'10
24	...	...	'949	1'057	'931	1'008	'986	'126	'059	2'14
25	...	...	'948	1'056	'930	1'006	'985	'126	'058	2'17
26	...	...	'947	1'055	'929	1'005	'984	'126	'058	2'17
27	...	...	'945	1'053	'927	1'003	'982	'126	'058	2'17
28	...	...	'943	1'052	'925	1'001	'980	'127	'058	2'19
29	...	...	'941	1'050	'922	'999	'978	'128	'058	2'21
30	...	...	'939	1'047	'920	'997	'976	'127	'058	2'19
31	...	...	'937	1'046	'918	'995	'974	'128	'058	2'21
Means	...	...	'957	1'063	'940	1'016	'994	'123	'060	2'07

## PRESSURE.

FEBRUARY.

DATE.			4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Amplitude of day oscillation.	Amplitude of night oscillation.	Ratio.
			29 +	29 +	29 +	29 +	29 +			
1	...	...	·985	1·044	·916	·994	·972	·128	·059	2·17
2	...	...	·984	1·043	·915	·993	·971	·128	·059	2·17
3	...	...	·982	1·041	·914	·992	·970	·127	·060	2·12
4	...	...	·981	1·040	·913	·990	·969	·127	·059	2·15
5	...	...	·980	1·039	·912	·990	·968	·127	·060	2·12
6	...	...	·929	1·088	·910	·990	·967	·128	·061	2·10
7	...	...	·927	1·086	·909	·990	·966	·127	·063	2·02
8	...	...	·927	1·085	·907	·991	·965	·128	·064	2·00
9	...	...	·924	1·084	·905	·990	·963	·129	·066	1·95
10	...	...	·922	1·082	·902	·988	·961	·130	·066	1·97
11	...	...	·920	1·080	·901	·987	·960	·129	·067	1·93
12	...	...	·920	1·080	·900	·988	·960	·130	·068	1·91
13	...	...	·920	1·081	·900	·988	·960	·131	·068	1·93
14	...	...	·921	1·081	·901	·988	·960	·130	·067	1·94
15	...	...	·921	1·080	·900	·987	·960	·130	·066	1·97
16	...	...	·919	1·028	·898	·985	·958	·130	·066	1·97
17	...	...	·917	1·027	·895	·984	·956	·132	·067	1·97
18	...	...	·915	1·025	·893	·982	·954	·132	·067	1·97
19	...	...	·913	1·024	·891	·981	·952	·133	·068	1·96
20	...	...	·911	1·021	·888	·977	·949	·133	·066	2·02
21	...	...	·908	1·018	·885	·973	·946	·133	·065	2·05
22	...	...	·905	1·015	·881	·968	·942	·134	·063	2·13
23	...	...	·903	1·011	·878	·964	·939	·133	·061	2·18
24	...	...	·900	1·008	·876	·961	·936	·132	·061	2·16
25	...	...	·897	1·006	·873	·958	·934	·133	·061	2·18
26	...	...	·894	1·003	·871	·955	·931	·132	·061	2·16
27	...	...	·891	1·000	·868	·951	·928	·132	·060	2·20
28	...	...	·887	·997	·865	·949	·925	·132	·062	2·13
29	...	...	·885	·994	·862	·946	·922	·132	·061	2·16
Means ...			·915	1·025	·894	·979	·953	·130	·064	2·06

## PRESSURE.

MARCH.

DATE.			4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Amplitude of day oscillation.	Amplitude of night oscillation.	Ratio.
			29 +	29 +	29 +	29 +	29 +			
1	...	...	882	992	860	944	920	132	062	2.13
2	...	...	880	990	859	942	918	131	062	2.11
3	...	...	879	988	857	940	916	131	061	2.15
4	...	...	877	985	855	937	914	130	060	2.17
5	...	...	874	985	853	935	911	130	061	2.13
6	...	...	872	980	851	933	909	129	061	2.11
7	...	...	870	978	848	931	907	130	061	2.13
8	...	...	867	974	845	928	904	129	061	2.11
9	...	...	864	971	842	925	901	129	061	2.11
10	...	...	862	968	840	923	898	128	061	2.10
11	...	...	860	966	838	921	896	128	061	2.10
12	...	...	858	963	835	918	894	128	060	2.13
13	...	...	855	959	831	914	890	128	059	2.17
14	...	...	852	955	827	910	886	128	058	2.21
15	...	...	848	951	823	906	882	128	058	2.21
16	...	...	844	946	818	901	877	128	057	2.25
17	...	...	839	941	813	897	873	128	058	2.21
18	...	...	835	937	809	892	868	128	057	2.25
19	...	...	830	932	804	887	863	128	057	2.25
20	...	...	826	928	800	883	859	128	057	2.25
21	...	...	823	924	797	879	856	127	056	2.27
22	...	...	819	921	794	876	853	127	057	2.23
23	...	...	817	919	792	874	851	127	057	2.23
24	...	...	815	917	790	872	849	127	057	2.23
25	...	...	813	915	788	869	846	127	056	2.27
26	...	...	810	912	785	866	843	127	056	2.27
27	...	...	807	909	782	863	840	127	056	2.27
28	...	...	804	906	779	861	838	127	057	2.23
29	...	...	802	904	777	858	835	127	056	2.27
30	...	...	800	901	775	856	833	126	056	2.25
31	...	...	798	898	772	853	830	126	055	2.29
Means ...			841	946	817	900	876	128	058	2.20

## PRESSURE.

APRIL.

DATE.			4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Amplitude of day oscillation.	Amplitude of night oscillation.	Ratio.
			29 +	29 +	29 +	29 +	29 +			
1	...	...	·796	·896	·770	·851	·828	·126	·055	2·29
2	...	...	·794	·898	·768	·849	·826	·125	·055	2·27
3	...	..	·792	·891	·766	·846	·824	·125	·054	2·31
4	...	...	·789	·889	·762	·843	·821	·127	·054	2·35
5	...	...	·786	·884	·759	·840	·817	·125	·054	2·31
6	...	...	·782	·881	·756	·837	·814	·125	·055	2·27
7	...	...	·779	·878	·752	·834	·811	·126	·055	2·29
8	...	...	·776	·875	·749	·831	·808	·126	·055	2·29
9	...	...	·773	·872	·746	·828	·805	·126	·055	2·29
10	...	...	·771	·868	·743	·825	·802	·125	·054	2·31
11	...	...	·768	·865	·741	·822	·799	·124	·055	2·25
12	...	...	·766	·863	·739	·822	·798	·124	·056	2·21
13	...	...	·764	·861	·737	·820	·796	·124	·056	2·21
14	...	...	·762	·858	·734	·817	·793	·124	·055	2·25
15	...	...	·759	·855	·731	·815	·790	·124	·056	2·21
16	...	...	·756	·852	·728	·813	·787	·124	·057	2·18
17	...	...	·754	·850	·726	·811	·785	·124	·057	2·18
18	...	...	·752	·847	·723	·809	·783	·124	·057	2·18
19	...	...	·749	·844	·721	·807	·780	·123	·058	2·12
20	...	...	·747	·842	·718	·804	·778	·124	·057	2·18
21	...	...	·745	·838	·716	·801	·775	·123	·056	2·18
22	...	...	·742	·834	·712	·798	·772	·122	·056	2·18
23	...	...	·738	·830	·709	·795	·768	·121	·057	2·12
24	...	...	·735	·826	·705	·791	·764	·121	·056	2·16
25	...	...	·731	·821	·702	·787	·760	·119	·056	2·13
26	...	...	·727	·817	·698	·783	·756	·119	·056	2·13
27	...	...	·722	·813	·694	·779	·752	·119	·057	2·09
28	...	...	·719	·809	·690	·776	·749	·119	·057	2·09
29	...	...	·715	·806	·687	·773	·745	·119	·058	2·05
30	...	...	·713	·803	·684	·770	·743	·119	·057	2·09
Means ...			·757	·852	·729	·813	·788	·123	·056	2·21

## PRESSURE.

MAY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Amplitude of day oscillation.	Amplitude of night oscillation.	Ratio.
	29 +	29 +	29 +	29 +	29 +			
1 ... ..	·710	·800	·681	·767	·740	·119	·057	2·09
2 ... ..	·707	·797	·678	·763	·736	·119	·056	2·13
3 ... ..	·704	·793	·674	·760	·733	·119	·056	2·13
4 ... ..	·700	·789	·671	·756	·729	·118	·056	2·11
5 ... ..	·697	·785	·668	·753	·726	·117	·056	2·09
6 ... ..	·694	·783	·665	·751	·723	·118	·057	2·07
7 ... ..	·692	·780	·663	·749	·721	·117	·057	2·05
8 ... ..	·691	·778	·661	·747	·719	·117	·056	2·09
9 ... ..	·689	·776	·659	·744	·717	·117	·055	2·13
10 ... ..	·686	·772	·655	·740	·713	·117	·054	2·17
11 ... ..	·683	·768	·651	·736	·710	·117	·053	2·21
12 ... ..	·678	·763	·646	·731	·705	·117	·053	2·21
13 ... ..	·673	·757	·641	·725	·699	·116	·052	2·23
14 ... ..	·668	·751	·636	·719	·694	·115	·051	2·25
15 ... ..	·663	·745	·631	·715	·689	·114	·052	2·19
16 ... ..	·658	·741	·627	·710	·684	·114	·052	2·19
17 ... ..	·654	·737	·623	·705	·680	·114	·051	2·24
18 ... ..	·649	·733	·619	·701	·676	·114	·052	2·19
19 ... ..	·646	·728	·615	·696	·671	·113	·050	2·26
20 ... ..	·642	·724	·611	·692	·667	·113	·050	2·26
21 ... ..	·639	·720	·606	·687	·663	·114	·048	2·33
22 ... ..	·634	·714	·600	·681	·657	·114	·047	2·43
23 ... ..	·628	·708	·595	·675	·652	·113	·047	2·40
24 ... ..	·623	·703	·589	·670	·646	·114	·047	2·43
25 ... ..	·618	·698	·585	·665	·642	·113	·047	2·40
26 ... ..	·614	·694	·582	·662	·638	·112	·048	2·33
27 ... ..	·611	·690	·578	·659	·635	·112	·048	2·33
28 ... ..	·609	·687	·575	·657	·632	·112	·048	2·33
29 ... ..	·606	·684	·573	·655	·630	·111	·049	2·27
30 ... ..	·604	·680	·570	·651	·626	·110	·047	2·34
31 ... ..	·601	·676	·566	·648	·623	·110	·047	2·34
Means ... ..	·657	·740	·626	·709	·683	·115	·052	2·23

## PRESSURE.

JUNE.

DATE.			4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Amplitude of day oscillation.	Amplitude of night oscillation.	Ratio.
			29 +	29 +	29 +	29 +	29 +			
1	...	...	·598	·672	·563	·646	·620	·109	·048	2·27
2	...	...	·596	·668	·560	·644	·617	·108	·048	2·25
3	...	...	·593	·665	·557	·642	·614	·108	·049	2·20
4	...	...	·589	·660	·554	·639	·611	·106	·050	2·12
5	...	...	·586	·656	·551	·636	·607	·105	·050	2·10
6	...	...	·583	·652	·548	·634	·604	·104	·051	2·04
7	...	...	·580	·649	·546	·631	·603	·103	·051	2·02
8	...	...	·577	·645	·543	·628	·598	·102	·051	2·00
9	...	...	·574	·641	·539	·625	·595	·102	·051	2·00
10	...	...	·570	·637	·536	·622	·591	·101	·052	1·94
11	...	...	·567	·633	·533	·620	·588	·100	·053	1·89
12	...	...	·565	·630	·532	·617	·586	·098	·052	1·88
13	...	...	·562	·628	·530	·616	·584	·098	·054	1·81
14	...	...	·561	·626	·530	·616	·583	·096	·055	1·75
15	...	...	·560	·626	·529	·615	·583	·097	·055	1·76
16	...	...	·559	·625	·529	·614	·582	·096	·055	1·75
17	...	...	·558	·624	·529	·614	·581	·095	·056	1·70
18	...	...	·557	·623	·529	·613	·581	·094	·056	1·68
19	...	...	·557	·623	·530	·613	·581	·093	·056	1·66
20	...	...	·557	·624	·530	·614	·581	·094	·057	1·65
21	...	...	·558	·624	·531	·615	·582	·093	·057	1·63
22	...	...	·559	·626	·534	·617	·584	·092	·058	1·59
23	...	...	·562	·628	·536	·620	·587	·092	·058	1·59
24	...	...	·564	·631	·539	·622	·589	·092	·058	1·59
25	...	...	·567	·633	·542	·625	·592	·091	·058	1·57
26	...	...	·569	·636	·545	·627	·594	·091	·058	1·57
27	...	...	·572	·639	·547	·630	·597	·092	·058	1·59
28	...	...	·574	·641	·549	·631	·599	·092	·057	1·61
29	...	...	·575	·642	·550	·632	·600	·092	·057	1·61
30	...	...	·577	·644	·551	·634	·602	·093	·057	1·63
Means ...			·571	·638	·541	·625	·594	·098	·054	1·82



## PRESSURE.

JULY.

DATE.			4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Amplitude of day oscillation.	Amplitude of night oscillation.	Ratio.
			29 +	29 +	29 +	29 +	29 +			
1	...	...	·578	·645	·552	·635	·603	·093	·067	1·63
2	...	...	·579	·646	·553	·636	·604	·093	·067	1·63
3	...	...	·579	·646	·552	·636	·603	·094	·067	1·65
4	...	...	·578	·644	·552	·635	·602	·092	·067	1·61
5	...	...	·577	·643	·551	·634	·601	·092	·067	1·61
6	...	...	·576	·642	·550	·633	·600	·092	·067	1·61
7	...	...	·575	·641	·548	·632	·599	·093	·067	1·63
8	...	...	·573	·640	·547	·631	·598	·093	·068	1·60
9	...	...	·573	·639	·546	·630	·597	·093	·067	1·63
10	...	...	·572	·637	·544	·627	·595	·093	·065	1·69
11	...	...	·569	·635	·541	·625	·593	·094	·066	1·63
12	...	...	·566	·632	·538	·622	·590	·094	·066	1·63
13	...	...	·563	·630	·535	·620	·587	·095	·067	1·67
14	...	...	·561	·627	·533	·618	·585	·094	·067	1·65
15	...	...	·559	·624	·530	·615	·583	·094	·066	1·63
16	...	...	·556	·622	·528	·612	·580	·094	·066	1·63
17	...	...	·554	·620	·526	·611	·578	·094	·067	1·65
18	...	...	·554	·621	·526	·612	·578	·095	·068	1·64
19	...	...	·555	·622	·526	·613	·579	·096	·068	1·66
20	...	...	·557	·624	·528	·615	·581	·096	·068	1·66
21	...	...	·559	·626	·529	·616	·583	·097	·067	1·70
22	...	...	·561	·628	·531	·618	·585	·097	·067	1·70
23	...	...	·562	·629	·532	·619	·586	·097	·067	1·70
24	...	...	·564	·631	·534	·621	·588	·097	·067	1·70
25	...	...	·565	·633	·535	·623	·589	·098	·068	1·69
26	...	...	·567	·635	·537	·625	·591	·098	·068	1·69
27	...	...	·570	·637	·539	·626	·593	·098	·066	1·75
28	...	...	·572	·639	·540	·627	·595	·099	·065	1·80
29	...	...	·573	·642	·541	·628	·596	·101	·065	1·84
30	...	...	·574	·644	·542	·630	·598	·102	·066	1·82
31	...	...	·576	·647	·544	·633	·600	·103	·067	1·81
Means ...			·568	·635	·539	·624	·592	·096	·067	1·63

## PRESSURE.

August.

DATE.			4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Amplitude of day oscillation.	Amplitude of night oscillation.	Ratio.
			29 +	29 +	29 +	29 +	29 +			
1	...	...	·579	·650	·547	·636	·603	·103	·057	1·81
2	...	...	·582	·654	·551	·639	·607	·103	·057	1·81
3	...	...	·584	·656	·553	·642	·609	·103	·058	1·78
4	...	...	·586	·659	·555	·644	·611	·104	·058	1·79
5	...	...	·588	·661	·557	·646	·613	·104	·058	1·79
6	...	...	·590	·663	·558	·648	·615	·105	·058	1·81
7	...	...	·592	·665	·560	·650	·617	·105	·058	1·81
8	...	...	·593	·667	·562	·652	·619	·105	·059	1·78
9	...	...	·595	·669	·563	·653	·620	·106	·058	1·83
10	...	...	·597	·671	·565	·655	·622	·106	·058	1·83
11	...	...	·598	·672	·566	·656	·623	·106	·058	1·83
12	...	...	·599	·673	·568	·659	·625	·105	·060	1·75
13	...	...	·601	·675	·571	·662	·627	·104	·061	1·70
14	...	...	·605	·678	·574	·665	·631	·104	·060	1·73
15	...	...	·608	·681	·576	·668	·633	·105	·058	1·81
16	...	...	·609	·682	·577	·666	·634	·105	·057	1·84
17	...	...	·609	·683	·577	·666	·634	·106	·057	1·86
18	...	...	·610	·684	·578	·667	·635	·106	·057	1·86
19	...	...	·611	·685	·579	·667	·637	·106	·056	1·89
20	...	...	·612	·687	·580	·668	·637	·107	·056	1·91
21	...	...	·613	·688	·581	·670	·638	·107	·057	1·88
22	...	...	·614	·690	·583	·672	·640	·107	·058	1·84
23	...	...	·616	·692	·585	·674	·642	·107	·058	1·84
24	...	...	·618	·695	·586	·677	·644	·109	·059	1·85
25	...	...	·620	·698	·589	·680	·647	·109	·060	1·83
26	...	...	·623	·701	·592	·683	·650	·109	·060	1·82
27	...	...	·626	·705	·596	·687	·654	·109	·061	1·79
28	...	...	·629	·709	·599	·691	·657	·110	·062	1·77
29	...	...	·632	·712	·602	·694	·660	·110	·062	1·77
30	...	...	·635	·715	·605	·697	·663	·110	·062	1·77
31	...	...	·638	·718	·607	·700	·666	·111	·062	1·79
Means ...			·607	·682	·576	·666	·633	·106	·059	1·81

## PRESSURE.

SEPTEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Amplitude of day oscillation.	Amplitude of night oscillation.	Ratio.
	29 +	29 +	29 +	29 +	29 +			
1 ...	640	720	610	703	668	110	063	1.75
2 ...	642	722	611	705	670	111	063	1.76
3 ...	644	723	612	707	672	111	063	1.76
4 ...	645	725	613	708	673	112	063	1.78
5 ...	646	726	614	709	674	112	063	1.78
6 ...	647	727	615	710	675	112	063	1.78
7 ...	648	729	617	711	676	112	063	1.78
8 ...	649	730	619	711	677	111	062	1.79
9 ...	651	731	620	712	679	111	061	1.82
10 ...	651	731	620	712	679	111	061	1.82
11 ...	651	731	619	710	675	112	059	1.90
12 ...	650	730	618	709	677	112	059	1.90
13 ...	648	729	618	708	676	111	060	1.85
14 ...	647	729	618	708	676	111	061	1.82
15 ...	647	730	619	709	676	111	062	1.79
16 ...	647	731	620	710	677	111	063	1.76
17 ...	649	734	623	713	680	111	064	1.73
18 ...	652	738	627	717	684	111	065	1.71
19 ...	656	742	631	721	688	111	065	1.71
20 ...	660	746	635	725	692	111	065	1.71
21 ...	664	751	640	729	696	111	065	1.71
22 ...	669	757	645	733	701	112	064	1.75
23 ...	674	762	651	739	707	111	065	1.71
24 ...	680	769	657	745	713	112	065	1.72
25 ...	686	776	663	752	719	113	066	1.71
26 ...	693	783	670	759	726	113	066	1.71
27 ...	700	790	677	766	733	113	066	1.71
28 ...	707	798	685	773	741	113	066	1.71
29 ...	714	805	691	779	747	114	065	1.75
30 ...	720	811	698	786	754	113	066	1.71
Means ...	663	747	635	726	693	112	063	1.76

## PRESSURE.

OCTOBER.

DATE.			4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Amplitude of day oscillation.	Amplitude of night oscillation.	Ratio.
			29 +	29 +	29 +	29 +	29 +			
1	...	...	·726	·817	·704	·792	·769	·113	·066	1·71
2	...	...	·732	·823	·710	·798	·766	·113	·066	1·71
3	...	...	·737	·829	·715	·802	·771	·114	·065	1·75
4	...	...	·742	·834	·720	·807	·776	·114	·065	1·75
5	...	...	·746	·839	·725	·811	·780	·114	·065	1·75
6	...	...	·750	·842	·729	·815	·784	·113	·065	1·74
7	...	...	·752	·845	·732	·819	·787	·113	·067	1·69
8	...	...	·755	·849	·736	·822	·791	·113	·067	1·69
9	...	...	·759	·853	·740	·826	·795	·113	·067	1·69
10	...	...	·763	·857	·745	·830	·799	·112	·067	1·67
11	...	...	·767	·862	·750	·834	·803	·112	·067	1·67
12	...	...	·772	·867	·755	·838	·808	·112	·066	1·70
13	...	...	·777	·872	·760	·843	·813	·112	·066	1·70
14	...	...	·781	·877	·765	·847	·818	·112	·066	1·70
15	...	...	·785	·881	·770	·850	·822	·111	·065	1·71
16	...	...	·789	·885	·774	·853	·825	·111	·064	1·73
17	...	...	·792	·888	·778	·855	·828	·110	·063	1·75
18	...	...	·794	·890	·780	·858	·831	·110	·064	1·72
19	...	...	·797	·893	·783	·860	·833	·110	·063	1·75
20	...	...	·800	·896	·787	·864	·837	·109	·064	1·70
21	...	...	·804	·900	·792	·868	·841	·108	·064	1·69
22	...	...	·809	·904	·796	·871	·845	·108	·062	1·74
23	...	...	·812	·907	·799	·874	·848	·108	·062	1·74
24	...	...	·814	·909	·801	·877	·850	·108	·063	1·71
25	...	...	·816	·910	·803	·878	·852	·107	·062	1·73
26	...	...	·817	·911	·804	·880	·853	·107	·063	1·70
27	...	...	·818	·912	·805	·881	·854	·107	·063	1·70
28	...	...	·820	·914	·807	·883	·856	·107	·063	1·70
29	...	...	·822	·917	·810	·886	·859	·107	·064	1·67
30	...	...	·825	·920	·813	·891	·862	·107	·066	1·63
31	...	...	·829	·924	·817	·896	·867	·107	·067	1·60
Means ...			·784	·878	·768	·849	·820	·110	·065	1·71

## PRESSURE.

NOVEMBER.

DATE.			4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Amplitude of day oscillation.	Amplitude of night oscillation.	Ratio.
			29 +	29 +	29 +	29 +	29 +			
1	...	...	'834	'829	'822	'901	'872	'107	'087	1'60
2	...	...	'839	'835	'828	'907	'877	'107	'088	1'57
3	...	...	'845	'841	'833	'913	'883	'108	'088	1'59
4	...	...	'851	'846	'839	'919	'889	'107	'088	1'57
5	...	...	'856	'852	'844	'924	'894	'108	'088	1'59
6	...	...	'862	'858	'849	'931	'900	'109	'089	1'58
7	...	...	'868	'864	'855	'936	'906	'109	'088	1'60
8	...	...	'875	'870	'862	'943	'913	'108	'088	1'59
9	...	...	'881	'877	'868	'949	'919	'109	'088	1'60
10	...	...	'888	'883	'874	'954	'925	'109	'086	1'65
11	...	...	'894	'888	'878	'959	'930	'110	'085	1'69
12	...	...	'897	'891	'881	'962	'933	'110	'085	1'69
13	...	...	'900	'894	'884	'965	'936	'110	'085	1'69
14	...	...	'903	'897	'887	'968	'939	'110	'085	1'69
15	...	...	'906	1'000	'889	'970	'941	'111	'084	1'73
16	...	...	'909	1'002	'891	'972	'944	'111	'083	1'76
17	...	...	'911	1'005	'894	'975	'946	'111	'084	1'73
18	...	...	'913	1'007	'896	'977	'948	'111	'084	1'73
19	...	...	'916	1'010	'899	'980	'951	'111	'084	1'73
20	...	...	'918	1'013	'901	'982	'953	'111	'084	1'73
21	...	...	'920	1'014	'902	'984	'955	'112	'084	1'75
22	...	...	'921	1'016	'904	'985	'957	'112	'084	1'75
23	...	...	'922	1'017	'905	'986	'958	'112	'084	1'75
24	...	...	'923	1'018	'906	'987	'959	'112	'084	1'75
25	...	...	'924	1'019	'908	'989	'960	'111	'085	1'71
26	...	...	'925	1'022	'910	'992	'962	'112	'087	1'67
27	...	...	'928	1'024	'913	'994	'965	'111	'086	1'68
28	...	...	'931	1'027	'915	'996	'967	'112	'085	1'72
29	...	...	'933	1'029	'917	'998	'969	'112	'085	1'72
30	...	...	'935	1'031	'920	1'000	'972	'111	'085	1'71
Means ...			'898	'993	'832	'963	'934	'110	'086	1'68

## PRESSURE.

DECEMBER.

DATE.			4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Amplitude of day oscillation.	Amplitude of night oscillation.	Ratio.
			29 +	29 +	29 +	29 +	29 +			
1	...	...	·937	1·034	·922	1·002	·974	·112	·065	1·72
2	...	...	·939	1·035	·924	1·004	·976	·111	·065	1·71
3	...	...	·940	1·036	·924	1·004	·976	·112	·064	1·75
4	...	...	·941	1·036	·924	1·004	·976	·112	·063	1·78
5	...	...	·941	1·037	·925	1·005	·977	·112	·064	1·75
6	...	...	·942	1·038	·926	1·006	·978	·112	·064	1·75
7	...	...	·944	1·039	·928	1·007	·980	·111	·063	1·76
8	...	...	·946	1·042	·930	1·010	·982	·112	·064	1·75
9	...	...	·948	1·045	·933	1·012	·985	·112	·064	1·75
10	...	...	·952	1·048	·935	1·015	·988	·113	·063	1·79
11	...	...	·955	1·051	·938	1·019	·991	·113	·064	1·77
12	...	...	·958	1·055	·942	1·022	·994	·113	·064	1·77
13	...	...	·961	1·058	·944	1·025	·997	·114	·064	1·78
14	...	...	·963	1·061	·946	1·027	·999	·115	·064	1·80
15	...	...	·965	1·063	·948	1·029	1·001	·115	·064	1·80
16	...	...	·967	1·065	·950	1·030	1·003	·115	·063	1·83
17	...	...	·969	1·068	·952	1·033	1·006	·116	·064	1·81
18	...	...	·972	1·070	·955	1·036	1·008	·115	·064	1·80
19	...	...	·975	1·073	·957	1·038	1·011	·116	·063	1·84
20	...	...	·978	1·076	·959	1·040	1·013	·117	·063	1·89
21	...	...	·980	1·078	·960	1·041	1·015	·118	·061	1·93
22	...	...	·981	1·079	·961	1·041	1·016	·118	·060	1·97
23	...	...	·981	1·080	·961	1·041	1·016	·119	·060	1·98
24	...	...	·980	1·079	·960	1·040	1·015	·119	·060	1·98
25	...	...	·978	1·078	·958	1·038	1·013	·120	·060	2·00
26	...	...	·976	1·077	·957	1·036	1·012	·120	·060	2·00
27	...	...	·975	1·076	·956	1·035	1·011	·120	·060	2·00
28	...	...	·975	1·075	·956	1·034	1·010	·119	·059	2·02
29	...	...	·975	1·075	·956	1·034	1·010	·119	·059	2·02
30	...	...	·975	1·075	·957	1·034	1·010	·118	·059	2·00
31	...	...	·975	1·076	·957	1·034	1·011	·119	·059	2·02
Means ...			·963	1·061	·945	1·025	·999	·115	·062	1·86

## TEMPERATURE.—DRY BULB.

JANUARY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Dry Maximum.	Dry Minimum.	Mean Temp.
							$\frac{2 \text{ Min.} + \text{Max.} + 16 \text{ Hrs.}}{4}$
1 ...	64.3	76.8	77.7	69.3	80.9	60.9	70.1
2 ...	64.2	76.8	77.8	69.2	80.9	60.7	70.0
3 ...	64.1	76.9	77.8	69.1	80.9	60.5	69.9
4 ...	64.0	76.9	77.8	69.0	80.9	60.3	69.8
5 ...	63.9	77.0	77.9	68.9	81.0	60.0	69.7
6 ...	63.8	77.1	78.0	68.8	81.0	59.8	69.7
7 ...	63.7	77.1	78.0	68.8	81.1	59.6	69.6
8 ...	63.6	77.2	78.2	68.7	81.2	59.4	69.6
9 ...	63.5	77.3	78.1	68.7	81.3	59.3	69.5
10 ...	63.5	77.4	78.2	68.6	81.4	59.3	69.6
11 ...	63.4	77.5	78.4	68.6	81.6	59.2	69.6
12 ...	63.4	77.6	78.6	68.7	81.8	59.2	69.7
13 ...	63.4	77.7	78.7	68.7	82.0	59.2	69.8
14 ...	63.4	77.7	78.7	68.8	82.1	59.2	69.8
15 ...	63.4	77.8	78.8	68.9	82.2	59.2	69.9
16 ...	63.4	77.9	78.9	68.9	82.4	59.4	70.0
17 ...	63.5	78.0	79.0	69.1	82.5	59.5	70.1
18 ...	63.7	78.1	79.1	69.3	82.6	59.8	70.3
19 ...	63.8	78.2	79.2	69.5	82.8	60.0	70.5
20 ...	64.0	78.3	79.3	69.7	82.9	60.3	70.7
21 ...	64.2	78.4	79.4	69.9	83.0	60.6	70.9
22 ...	64.4	78.5	79.5	70.1	83.2	60.9	71.1
23 ...	64.6	78.5	79.6	70.3	83.3	61.1	71.3
24 ...	64.8	78.6	79.7	70.5	83.4	61.6	71.6
25 ...	65.0	78.7	79.8	70.7	83.4	61.9	71.8
26 ...	65.2	78.8	79.9	70.8	83.5	62.3	72.0
27 ...	65.4	78.9	79.9	71.0	83.5	62.5	72.1
28 ...	65.6	79.0	80.0	71.1	83.6	62.8	72.3
29 ...	65.8	79.1	80.1	71.3	83.7	63.0	72.5
30 ...	66.0	79.2	80.2	71.4	83.8	63.3	72.7
31 ...	66.2	79.3	80.3	71.6	83.8	63.5	72.8
Means ...	64.2	77.9	78.9	69.6	82.3	60.6	70.6

## TEMPERATURE.—DRY BULB.

FEBRUARY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Dry Maximum.	Dry Minimum.	Mean Temp.
							$\frac{2 \text{ Min.} + \text{Max.} + 16 \text{ Hrs.}}{4}$
1 ...	66.4	79.4	80.4	71.7	83.9	63.7	73.9
2 ...	66.6	79.5	80.5	71.8	84.0	63.9	73.1
3 ...	66.8	79.7	80.6	72.0	84.1	64.1	73.2
4 ...	67.0	79.8	80.7	72.2	84.2	64.3	73.4
5 ...	67.2	79.9	80.8	72.4	84.4	64.6	73.6
6 ...	67.4	80.1	81.0	72.6	84.5	64.9	73.8
7 ...	67.7	80.2	81.1	72.7	84.6	65.2	74.0
8 ...	67.9	80.4	81.2	73.0	84.7	65.4	74.2
9 ...	68.1	80.5	81.3	73.2	84.9	65.6	74.4
10 ...	68.4	80.7	81.5	73.4	85.0	65.8	74.5
11 ..	68.6	80.8	81.6	73.6	85.2	66.1	74.8
12 ...	68.8	81.0	81.8	73.8	85.3	66.3	74.9
13 ...	68.9	81.1	81.9	74.0	85.5	66.5	75.1
14 ...	69.1	81.2	82.0	74.1	85.7	66.7	75.3
15 ...	69.3	81.4	82.2	74.3	85.9	66.8	75.4
16 ...	69.4	81.5	82.4	74.5	86.1	66.9	75.6
17 ...	69.6	81.7	82.6	74.7	86.3	67.0	75.7
18 ...	69.7	81.9	82.7	74.9	86.4	67.1	75.8
19 ...	69.9	82.1	82.9	75.0	86.5	67.3	76.0
20 ...	70.0	82.3	83.0	75.2	86.7	67.3	76.1
21 ...	70.2	82.5	83.2	75.4	86.9	67.5	76.3
22 ...	70.4	82.7	83.4	75.6	87.2	67.6	76.5
23 ...	70.6	83.0	83.6	75.8	87.4	67.8	76.7
24 ...	70.7	83.2	83.7	75.9	87.6	67.9	76.8
25 ...	70.9	83.3	83.9	76.1	87.8	68.1	77.0
26 ...	71.1	83.5	84.0	76.2	87.9	68.3	77.1
27 ...	71.2	83.7	84.1	76.4	88.0	68.5	77.3
28 ...	71.4	83.8	84.2	76.6	88.1	68.7	77.4
Means ...	69.0	81.5	82.2	74.2	85.9	66.4	75.2



## TEMPERATURE.—DRY BULB.

MARCH.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Dry Maximum.	Dry Minimum.	Mean. Temp.
							$\frac{2 \text{ Min.} + \text{Max.} + 16 \text{ Hrs.}}{4}$
1 ...	71.7	84.1	84.3	76.9	88.2	69.1	77.7
2 ...	71.9	84.2	84.3	77.1	88.3	69.3	77.8
3 ...	72.1	84.3	84.3	77.2	88.4	69.5	77.9
4 ...	72.3	84.3	84.4	77.4	88.5	69.7	78.1
5 ...	72.6	84.4	84.4	77.6	88.6	69.9	78.2
6 ...	72.8	84.5	85.5	77.7	88.8	70.2	78.4
7 ...	73.1	84.6	84.5	77.9	88.9	70.5	78.6
8 ...	73.3	84.7	84.6	78.0	89.0	70.7	78.8
9 ...	73.6	84.8	84.6	78.1	89.0	71.0	78.9
10 ...	73.8	84.8	84.6	78.3	89.1	71.3	79.1
11 ...	74.0	84.9	84.6	78.4	89.1	71.5	79.2
12 ...	74.3	85.0	84.7	78.6	89.3	71.8	79.4
13 ...	74.5	85.1	84.8	78.7	89.4	72.0	79.6
14 ...	74.8	85.3	84.9	78.9	89.6	72.3	79.8
15 ...	75.0	85.4	85.0	79.1	89.7	72.5	79.9
16 ...	75.2	85.6	85.2	79.2	89.9	72.7	80.1
17 ...	75.4	85.7	85.3	79.4	90.1	73.0	80.4
18 ...	75.6	85.9	85.4	79.5	90.3	73.2	80.5
19 ...	75.7	86.1	85.5	79.7	90.4	73.5	80.7
20 ...	75.9	86.2	85.6	79.8	90.6	73.8	81.0
21 ...	76.1	86.4	85.7	79.9	90.8	74.0	81.1
22 ...	76.2	86.5	85.8	80.0	91.0	74.2	81.3
23 ...	76.4	86.6	86.0	80.1	91.2	74.4	81.5
24 ...	76.5	86.7	86.1	80.2	91.4	74.6	81.7
25 ...	76.7	86.9	86.2	80.3	91.6	74.8	81.9
26 ...	76.8	87.0	86.4	80.4	91.8	74.9	82.0
27 ...	77.0	87.1	86.5	80.5	91.9	75.1	82.2
28 ...	77.1	87.3	86.7	80.6	92.1	75.2	82.3
29 ...	77.3	87.4	86.8	80.7	92.3	75.4	82.5
30 ...	77.4	87.5	86.9	80.8	92.5	75.6	82.7
31 ...	77.6	87.6	87.0	80.8	92.6	75.8	82.8
Means ...	74.9	85.7	85.3	79.1	90.1	72.6	80.2

## TEMPERATURE.—DRY BULB.

APRIL.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Dry Maximum.	Dry Minimum.	Mean Temp.
							$\frac{2 \text{ Min.} + \text{Max.} + 16 \text{ Hrs.}}{4}$
1 ...	77.8	87.7	87.0	80.9	92.7	76.0	82.9
2 ...	77.9	87.8	87.1	80.9	92.7	76.1	83.0
3 ...	78.1	87.9	87.2	81.0	92.8	76.3	83.2
4 ...	78.2	88.1	87.3	81.1	92.8	76.5	83.3
5 ...	78.4	88.2	87.4	81.2	92.9	76.6	83.4
6 ...	78.5	88.4	87.4	81.2	92.9	76.8	83.5
7 ...	78.7	88.6	87.5	81.3	92.9	77.0	83.6
8 ...	78.8	88.7	87.6	81.4	93.0	77.1	83.7
9 ...	78.9	88.8	87.7	81.5	93.0	77.3	83.8
10 ...	79.1	89.0	87.7	81.5	93.1	77.4	83.9
11 ...	79.2	89.1	87.7	81.5	93.1	77.5	84.0
12 ...	79.2	89.2	87.7	81.6	93.0	77.6	84.0
13 ...	79.3	89.3	87.7	81.6	93.0	77.7	84.0
14 ...	79.4	89.5	87.7	81.7	93.1	77.9	84.2
15 ...	79.5	89.6	87.8	81.8	93.2	78.0	84.3
16 ...	79.6	89.7	87.8	81.9	93.3	78.1	84.3
17 ...	79.7	89.8	87.9	82.0	93.4	78.2	84.4
18 ...	79.8	89.9	88.0	82.0	93.5	78.3	84.5
19 ...	79.9	90.0	88.0	82.1	93.6	78.4	84.6
20 ...	80.0	90.1	88.0	82.2	93.7	78.5	84.7
21 ...	80.1	90.1	88.0	82.3	93.7	78.6	84.7
22 ...	80.2	90.2	88.1	82.4	93.9	78.7	84.9
23 ...	80.3	90.3	88.1	82.5	94.0	78.8	84.9
24 ...	80.4	90.4	88.2	82.7	94.2	79.0	85.1
25 ...	80.5	90.4	88.3	82.8	94.3	79.2	85.3
26 ...	80.7	90.5	88.4	82.9	94.4	79.4	85.4
27 ...	80.8	90.5	88.4	83.1	94.4	79.6	85.5
28 ...	80.9	90.5	88.5	83.2	94.4	79.7	85.6
29 ...	81.0	90.5	88.5	83.3	94.4	79.9	85.7
30 ...	81.2	90.5	88.6	83.4	94.5	80.0	85.8
Means ...	79.5	89.4	87.8	82.0	93.5	78.0	84.3

## TEMPERATURE.—DRY BULB.

MAY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Dry Maximum.	Dry Minimum.	Mean Temp.
							$\frac{2 \text{ Min.} + \text{Max.} + 16 \text{ Hrs.}}{4}$
1 ...	81.3	90.6	88.6	88.5	94.5	80.1	85.8
2 ...	81.4	90.6	88.7	88.6	94.5	80.2	85.9
3 ...	81.5	90.6	88.7	88.7	94.6	80.3	86.0
4 ...	81.6	90.6	88.8	88.7	94.6	80.4	86.1
5 ...	81.7	90.6	88.9	88.8	94.7	80.5	86.2
6 ...	81.7	90.6	89.0	88.8	94.7	80.6	86.2
7 ...	81.8	90.6	89.0	88.8	94.7	80.6	86.2
8 ...	81.9	90.6	89.1	88.8	94.6	80.6	86.2
9 ...	81.9	90.6	89.1	88.9	94.6	80.6	86.2
10 ...	82.0	90.6	89.2	88.9	94.7	80.7	86.3
11 ...	82.1	90.6	89.4	84.0	94.9	80.7	86.4
12 ...	82.1	90.7	89.5	84.0	95.1	80.7	86.5
13 ...	82.2	90.8	89.7	84.1	95.3	80.8	86.7
14 ...	82.3	90.8	89.8	84.2	95.5	80.9	86.8
15 ...	82.4	90.8	89.9	84.3	95.6	81.0	86.9
16 ...	82.5	90.9	90.0	84.3	95.7	81.1	87.0
17 ...	82.6	90.9	90.0	84.3	95.7	81.2	87.0
18 ...	82.6	90.9	90.0	84.3	95.8	81.3	87.1
19 ...	82.7	90.9	90.1	84.4	95.8	81.4	87.2
20 ...	82.8	90.8	90.2	84.4	95.9	81.5	87.3
21 ...	82.8	90.8	90.2	84.5	96.0	81.6	87.4
22 ...	82.9	90.9	90.3	84.6	96.1	81.8	87.5
23 ...	83.0	90.9	90.3	84.7	96.2	81.9	87.6
24 ...	83.1	90.9	90.3	84.7	96.2	82.1	87.7
25 ...	83.2	90.8	90.2	84.8	96.2	82.2	87.7
26 ...	83.2	90.8	90.2	84.8	96.0	82.2	87.7
27 ...	83.2	90.7	90.1	84.8	95.9	82.3	87.7
28 ...	83.2	90.7	90.1	84.8	95.7	82.3	87.6
29 ...	83.3	90.7	90.0	84.9	95.6	82.2	87.5
30 ...	83.3	90.7	90.0	84.9	95.5	82.2	87.5
31 ...	83.3	90.6	89.9	84.9	95.4	82.1	87.4
Means ...	82.4	90.7	89.7	84.3	95.4	81.2	86.9

## TEMPERATURE.—DRY. BULB.

JUNE.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Dry Maximum.	Dry Minimum.	Mean Temp.
							$\frac{3 \text{ Min.} + \text{Max.} + 16 \text{ Hrs.}}{4}$
1 ...	83.3	90.6	89.8	84.9	95.4	82.1	87.4
2 ...	83.3	90.5	89.7	84.9	95.2	82.0	87.2
3 ...	83.3	90.4	89.6	84.8	95.1	81.9	87.1
4 ...	83.3	90.3	89.6	84.8	94.9	81.8	87.0
5 ...	83.2	90.2	89.5	84.8	94.7	81.7	86.9
6 ...	83.2	90.0	89.5	84.7	94.6	81.6	86.8
7 ...	83.1	89.9	89.4	84.6	94.5	81.5	86.7
8 ...	83.0	89.8	89.4	84.5	94.4	81.4	86.7
9 ...	82.9	89.7	89.3	84.5	94.2	81.3	86.5
10 ...	82.8	89.6	89.3	84.4	94.1	81.1	86.4
11 ...	82.8	89.4	89.2	84.3	94.0	81.0	86.3
12 ...	82.7	89.3	89.1	84.2	93.9	80.9	86.2
13 ...	82.5	89.1	89.0	84.1	93.8	80.8	86.1
14 ...	82.4	89.0	89.0	84.0	93.8	80.7	86.1
15 ...	82.3	88.9	89.0	83.9	93.8	80.6	86.0
16 ...	82.2	88.9	89.0	83.8	93.8	80.5	86.0
17 ...	82.1	88.8	89.0	83.7	93.9	80.5	86.0
18 ...	82.0	88.7	89.0	83.6	93.9	80.4	85.9
19 ...	81.8	88.6	89.0	83.5	93.9	80.4	85.9
20 ...	81.7	88.5	88.9	83.4	93.8	80.3	85.8
21 ...	81.5	88.4	88.8	83.3	93.7	80.2	85.7
22 ...	81.4	88.3	88.7	83.2	93.5	80.0	85.6
23 ...	81.3	88.1	88.5	83.1	93.3	79.9	85.4
24 ...	81.2	88.0	88.4	82.9	93.2	79.7	85.3
25 ...	81.1	87.9	88.3	82.8	93.2	79.6	85.2
26 ...	80.9	87.7	88.2	82.6	93.1	79.5	85.1
27 ...	80.8	87.7	88.1	82.5	93.1	79.4	85.0
28 ...	80.7	87.6	88.0	82.4	93.0	79.3	84.9
29 ...	80.6	87.4	88.0	82.3	92.9	79.3	84.9
30 ...	80.5	87.4	87.9	82.1	92.8	79.2	84.8
Means ...	82.1	89.0	88.9	83.8	93.9	80.6	86.0

## TEMPERATURE.—DRY BULB.

JULY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Dry Maximum.	Dry Minimum.	Mean Temp.
							$\frac{2 \text{ Min.} + \text{Max.} + 16 \text{ Hrs.}}{4}$
1 ...	80.3	87.3	87.8	82.0	92.5	79.0	84.6
2 ...	80.2	87.1	87.6	81.9	92.3	78.9	84.4
3 ...	80.1	86.9	87.5	81.7	92.1	78.7	84.3
4 ...	79.9	86.7	87.3	81.6	91.8	78.6	84.1
5 ...	79.8	86.5	87.2	81.4	91.6	78.4	83.9
6 ...	79.6	86.3	87.0	81.3	91.4	78.3	83.8
7 ...	79.5	86.2	86.9	81.2	91.3	78.2	83.7
8 ...	79.4	86.0	86.8	81.2	91.2	78.1	83.6
9 ...	79.3	85.9	86.8	81.2	91.1	78.1	83.5
10 ...	79.2	85.8	86.7	81.2	91.0	78.2	83.5
11 ...	79.1	85.7	86.7	81.2	90.9	78.2	83.5
12 ...	79.1	85.6	86.6	81.2	90.6	78.1	83.4
13 ...	79.0	85.4	86.6	81.1	90.4	78.0	83.3
14 ...	79.0	85.3	86.5	81.1	90.2	77.9	83.1
15 ...	78.9	85.2	86.5	81.1	90.1	77.9	83.1
16 ...	78.9	85.1	86.4	81.2	90.1	77.9	83.1
17 ...	78.9	85.0	86.4	81.2	90.1	77.9	83.1
18 ...	78.9	85.0	86.4	81.2	90.2	78.0	83.2
19 ...	79.0	85.0	86.4	81.3	90.2	78.1	83.2
20 ...	79.1	85.0	86.5	81.3	90.2	78.2	83.3
21 ...	79.2	85.1	86.6	81.4	90.3	78.3	83.4
22 ...	79.3	85.1	86.7	81.5	90.3	78.4	83.5
23 ...	79.4	85.2	86.8	81.6	90.4	78.5	83.6
24 ...	79.5	85.2	86.8	81.6	90.3	78.5	83.5
25 ...	79.5	85.2	86.8	81.7	90.3	78.5	83.5
26 ...	79.6	85.2	86.8	81.7	90.3	78.4	83.5
27 ...	79.6	85.3	86.9	81.7	90.4	78.4	83.5
28 ...	79.7	85.3	86.9	81.8	90.5	78.5	83.6
29 ...	79.7	85.3	86.9	81.9	90.5	78.5	83.6
30 ...	79.8	85.3	87.0	82.0	90.4	78.5	83.6
31 ...	79.8	85.4	87.0	82.0	90.4	78.5	83.6
Means ...	79.4	85.6	86.8	81.5	90.3	78.3	83.6

**TEMPERATURE.—DRY BULB.**  
**August.**

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Dry Maximum.	Dry Minimum.	Mean Temp.
							$\frac{2 \text{ Min.} + \text{Max.} + 16 \text{ Hrs.}}{4}$
1 ...	79.9	85.4	87.1	83.1	90.3	78.4	83.6
2 ...	80.0	85.5	87.1	82.1	90.3	78.4	83.6
3 ...	80.0	85.5	87.1	82.1	90.3	78.3	83.5
4 ...	80.0	85.5	87.0	82.1	90.4	78.3	83.5
5 ...	80.0	85.5	87.0	82.1	90.4	78.3	83.5
6 ...	80.0	85.5	87.0	82.1	90.5	78.3	83.5
7 ...	80.0	85.5	87.0	82.1	90.6	78.3	83.6
8 ...	79.9	85.5	86.9	82.0	90.6	78.3	83.5
9 ...	79.9	85.5	86.9	82.0	90.7	78.4	83.6
10 ...	79.9	85.5	86.9	82.0	90.8	78.5	83.7
11 ...	79.9	85.5	86.9	82.0	90.9	78.5	83.7
12 ...	79.9	85.6	86.9	81.9	90.9	78.5	83.7
13 ...	79.8	85.6	86.8	81.9	90.9	78.4	83.6
14 ...	79.8	85.6	86.8	81.8	90.9	78.3	83.6
15 ...	79.8	85.7	86.8	81.8	90.9	78.3	83.6
16 ...	79.7	85.8	86.7	81.7	91.0	78.3	83.6
17 ...	79.6	85.9	86.7	81.7	91.0	78.3	83.6
18 ...	79.6	86.0	86.7	81.7	91.0	78.2	83.5
19 ...	79.5	86.1	86.7	81.6	91.0	78.1	83.5
20 ...	79.5	86.1	86.7	81.6	90.9	78.1	83.5
21 ...	79.4	86.1	86.6	81.5	90.9	78.0	83.4
22 ...	79.3	86.2	86.5	81.5	90.8	77.9	83.3
23 ...	79.2	86.2	86.5	81.4	90.7	77.7	83.2
24 ...	79.2	86.1	86.4	81.3	90.7	77.6	83.1
25 ...	79.1	86.1	86.3	81.3	90.6	77.5	83.0
26 ...	79.0	86.0	86.1	81.2	90.5	77.4	82.9
27 ...	78.9	86.0	86.0	81.1	90.4	77.3	82.8
28 ...	78.9	85.9	85.9	81.1	90.4	77.3	82.7
29 ...	78.8	85.8	85.9	81.0	90.3	77.2	82.7
30 ...	78.7	85.7	85.8	80.9	90.3	77.2	82.6
31 ...	78.7	85.6	85.7	80.9	90.3	77.2	82.6
Means ...	79.5	85.8	86.6	81.7	90.7	78.0	83.3

## TEMPERATURE.—DRY BULB.

SEPTEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Dry Maximum.	Dry Minimum.	Mean Temp.
							$\frac{2 \text{ Min.} + \text{Max} + 16 \text{ Hrs.}}{4}$
1 ...	78.6	85.5	85.6	80.8	90.2	77.2	82.6
2 ...	78.6	85.4	85.6	80.8	90.2	77.2	82.6
3 ...	78.6	85.4	85.6	80.8	90.1	77.2	82.5
4 ...	78.6	85.3	85.6	80.8	90.1	77.2	82.5
5 ...	78.6	85.3	85.7	80.8	90.1	77.2	82.6
6 ...	78.6	85.3	85.8	80.8	90.1	77.2	82.6
7 ...	78.7	85.3	85.9	80.8	90.1	77.2	82.6
8 ...	78.7	85.3	86.0	80.9	90.1	77.2	82.6
9 ...	78.7	85.3	86.1	80.9	90.1	77.2	82.7
10 ...	78.7	85.3	86.2	80.9	90.2	77.2	82.7
11 ...	78.8	85.4	86.3	80.9	90.2	77.3	82.8
12 ...	78.8	85.4	86.4	80.9	90.2	77.3	82.8
13 ...	78.8	85.5	86.4	80.9	90.2	77.3	82.8
14 ...	78.8	85.5	86.5	80.9	90.2	77.3	82.8
15 ...	78.8	85.5	86.5	80.9	90.1	77.2	82.8
16 ...	78.7	85.6	86.5	80.9	90.1	77.2	82.8
17 ...	78.7	85.6	86.5	80.9	90.1	77.2	82.8
18 ...	78.7	85.6	86.5	80.8	90.1	77.1	82.7
19 ...	78.6	85.6	86.4	80.8	90.1	77.0	82.6
20 ...	78.6	85.7	86.4	80.7	90.1	77.0	82.6
21 ...	78.5	85.7	86.3	80.6	90.0	76.9	82.5
22 ...	78.4	85.7	86.2	80.5	90.0	76.8	82.5
23 ...	78.3	85.8	86.2	80.5	90.1	76.8	82.5
24 ...	78.3	85.9	86.1	80.4	90.1	76.7	82.4
25 ...	78.2	85.9	86.1	80.4	90.1	76.6	82.4
26 ...	78.1	86.0	86.0	80.3	90.2	76.5	82.3
27 ...	78.0	86.1	86.0	80.3	90.3	76.4	82.3
28 ...	78.0	86.2	86.0	80.2	90.3	76.3	82.2
29 ...	77.9	86.2	86.1	80.2	90.4	76.3	82.2
30 ...	77.8	86.3	86.1	80.1	90.5	76.1	82.2
Means ...	78.5	85.6	86.1	80.7	90.2	77.0	82.6

## TEMPERATURE.—DRY BULB.

OCTOBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Dry Maximum.	Dry Minimum.	Mean Temp.
							$\frac{2 \text{ Min.} + \text{Max.} + 16 \text{ Hrs.}}{4}$
1 ...	77.7	86.8	86.0	80.1	90.5	76.0	82.1
2 ...	77.6	86.4	86.0	80.0	90.6	75.8	82.1
3 ...	77.5	86.3	86.0	79.9	90.5	75.7	82.0
4 ...	77.4	86.3	85.9	79.8	90.5	75.5	81.9
5 ...	77.3	86.3	85.8	79.7	90.4	75.3	81.7
6 ...	77.1	86.2	85.7	79.6	90.3	75.1	81.6
7 ...	77.0	86.1	85.7	79.6	90.2	74.9	81.4
8 ...	76.9	86.0	85.6	79.5	90.1	74.7	81.3
9 ...	76.7	85.9	85.5	79.4	90.0	74.5	81.1
10 ...	76.5	85.6	85.4	79.2	89.8	74.2	80.9
11 ...	76.4	85.7	85.3	79.1	89.7	74.0	80.8
12 ...	76.2	85.6	85.2	78.9	89.5	73.7	80.5
13 ...	75.9	85.5	85.1	78.8	89.3	73.4	80.3
14 ...	75.7	85.4	85.0	78.6	89.2	73.1	80.1
15 ...	75.5	85.3	84.9	78.4	89.1	72.9	79.9
16 ...	75.3	85.2	84.8	78.3	88.9	72.7	79.8
17 ...	75.0	85.1	84.7	78.1	88.8	72.5	79.6
18 ...	74.8	85.1	84.6	77.9	88	72.3	79.5
19 ...	74.6	85.0	84.5	77.8	88.7	72.1	79.4
20 ...	74.4	85.0	84.5	77.6	88.7	71.9	79.3
21 ...	74.2	85.0	84.4	77.5	88.6	71.8	79.2
22 ...	74.0	84.9	84.3	77.3	88.5	71.6	79.0
23 ...	73.8	84.8	84.2	77.1	88.4	71.5	78.9
24 ...	73.5	84.7	84.1	76.9	88.2	71.3	78.7
25 ...	73.3	84.3	84.0	76.8	88.1	71.1	78.6
26 ...	73.1	84.4	83.8	76.6	88.0	71.0	78.5
27 ...	73.0	84.3	83.6	76.5	87.9	70.9	78.3
28 ...	72.8	84.1	83.5	76.4	87.8	70.8	78.2
29 ...	72.7	84.0	83.3	76.2	87.6	70.7	78.1
30 ...	72.5	83.8	83.2	76.2	87.5	70.6	78.0
31 ...	72.4	83.6	83.0	76.1	87.3	70.5	77.8
Means ...	75.2	85.2	84.8	78.2	89.1	73.0	80.0



## TEMPERATURE.—DRY BULB.

NOVEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Dry Maximum.	Dry Minimum.	Mean Temp.
							$\frac{2 \text{ Min.} + \text{Max.} + 16 \text{ Hrs.}}{4}$
1 ...	72.3	83.5	82.9	76.0	87.1	70.4	77.7
2 ...	72.3	83.3	82.8	75.9	87.0	70.2	77.6
3 ...	72.2	83.2	82.6	75.8	86.8	70.0	77.4
4 ...	72.1	83.0	82.5	75.7	86.4	69.8	77.1
5 ...	72.0	82.8	82.3	75.6	86.3	69.6	77.0
6 ...	71.8	82.6	82.2	75.5	86.2	69.3	76.8
7 ...	71.7	82.4	82.1	75.4	86.1	69.2	76.7
8 ...	71.6	82.3	82.0	75.3	86.0	69.1	76.6
9 ...	71.5	82.1	81.9	75.2	85.9	69.0	76.5
10 ...	71.5	81.9	81.7	75.1	85.8	68.8	76.3
11 ...	71.4	81.7	81.6	74.9	85.4	68.6	76.1
12 ...	71.3	81.5	81.4	74.8	85.4	68.4	75.9
13 ...	71.2	81.3	81.3	74.7	85.2	68.2	75.7
14 ...	71.2	81.2	81.1	74.6	85.0	68.1	75.6
15 ...	71.1	81.0	80.9	74.5	84.8	67.9	75.4
16 ...	71.0	80.8	80.7	74.3	84.6	67.8	75.3
17 ...	70.9	80.6	80.5	74.2	84.5	67.7	75.1
18 ...	70.8	80.4	80.4	74.1	84.3	67.6	75.0
19 ...	70.7	80.2	80.2	74.0	84.2	67.6	74.9
20 ...	70.6	80.0	80.0	73.9	84.0	67.6	74.8
21 ...	70.5	79.9	79.8	73.7	83.8	67.5	74.7
22 ...	70.3	79.7	79.6	73.5	83.6	67.3	74.5
23 ...	70.1	79.6	79.4	73.4	83.5	67.2	74.3
24 ...	69.9	79.4	79.3	73.2	83.3	67.0	74.2
25 ...	69.6	79.3	79.2	73.0	83.2	66.9	74.1
26 ...	69.4	79.3	79.1	72.9	83.2	66.8	74.0
27 ...	69.1	79.2	79.0	72.7	83.1	66.7	73.9
28 ...	68.9	79.1	78.9	72.4	83.1	66.5	73.8
29 ...	68.6	79.0	78.8	72.2	83.1	66.2	73.6
30 ...	68.3	79.0	78.7	72.0	83.0	65.9	73.4
Means ...	70.8	81.0	80.8	74.3	84.8	68.1	75.5

## TEMPERATURE.—DRY BULB.

DECEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Dry Maximum.	Dry Minimum.	Mean Temp.
							$\frac{3 \text{ Min.} + \text{Max.} + 16 \text{ Hrs.}}{4}$
1 ...	68.0	78.9	78.6	71.7	83.0	65.6	73.2
2 ...	67.6	78.8	78.6	71.5	82.9	65.2	73.0
3 ...	67.3	78.7	78.5	71.2	82.8	64.7	72.7
4 ...	67.0	78.6	78.4	71.0	82.7	64.3	72.4
5 ...	66.7	78.5	78.4	70.9	82.6	63.9	72.2
6 ...	66.5	78.5	78.4	70.8	82.5	63.6	72.0
7 ...	66.3	78.4	78.4	70.7	82.4	63.4	71.9
8 ...	66.2	78.4	78.3	70.6	82.3	63.1	71.7
9 ...	66.0	78.3	78.3	70.6	82.2	62.9	71.6
10 ...	65.9	78.3	78.3	70.5	82.1	62.8	71.5
11 ...	65.9	78.2	78.2	70.5	82.0	62.6	71.4
12 ...	65.8	78.1	78.2	70.4	81.9	62.5	71.3
13 ...	65.7	78.0	78.1	70.4	81.8	62.3	71.1
14 ...	65.5	77.8	78.0	70.3	81.7	62.3	71.1
15 ...	65.5	77.7	78.0	70.2	81.7	62.2	71.0
16 ...	65.4	77.6	77.9	70.2	81.6	62.3	71.0
17 ...	65.4	77.5	77.8	70.2	81.6	62.5	71.1
18 ...	65.4	77.4	77.8	70.2	81.6	62.6	71.2
19 ...	65.4	77.3	77.7	70.1	81.6	62.7	71.2
20 ...	65.4	77.2	77.6	70.1	81.6	62.8	71.2
21 ...	65.3	77.1	77.6	70.5	81.5	62.9	71.2
22 ...	65.3	77.0	77.5	69.9	81.5	62.8	71.2
23 ...	65.1	76.9	77.5	69.8	81.4	62.7	71.1
24 ...	65.0	76.8	77.4	69.7	81.4	62.5	71.0
25 ...	64.9	76.7	77.4	69.6	81.3	62.2	70.8
26 ...	64.8	76.7	77.4	69.5	81.2	61.9	70.6
27 ...	64.7	76.6	77.4	69.4	81.1	61.6	70.4
28 ...	64.6	76.6	77.4	69.4	81.0	61.5	70.4
29 ...	64.6	76.6	77.5	69.4	81.0	61.4	70.3
30 ...	64.5	76.7	77.6	69.4	81.0	61.3	70.3
31 ...	64.5	76.7	77.6	69.3	80.9	61.1	70.2
Means ...	65.7	77.6	77.9	70.3	81.3	62.3	71.3

## NOCTURNAL RADIATION.

DATE.	JANUARY.		FEBRUARY.		MARCH.		APRIL.	
	Grass minimum therm.	Depression below dry minimum in shade.	Grass minimum therm.	Depression below dry minimum in shade.	Grass minimum therm.	Depression below dry minimum in shade.	Grass minimum therm.	Depression below dry minimum in shade.
1 ...	56.8	4.1	57.3	6.5	63.7	5.4	71.9	4.1
2 ...	56.7	4.0	57.3	6.6	64.0	5.3	72.1	4.0
3 ...	56.5	4.0	57.5	6.6	64.3	5.2	72.3	4.0
4 ...	56.4	3.9	57.7	6.6	64.5	5.2	72.5	4.0
5 ...	56.2	3.8	58.0	6.6	64.7	5.2	72.7	3.9
6 ...	56.0	3.8	58.3	6.6	64.9	5.3	72.8	4.0
7 ...	55.8	3.8	58.6	6.6	65.1	5.4	73.0	4.0
8 ...	55.7	3.7	58.9	6.5	65.4	5.3	73.1	4.0
9 ...	55.6	3.7	59.2	6.4	65.7	5.3	73.2	4.1
10 ...	55.5	3.8	59.4	6.4	65.9	5.4	73.3	4.1
11 ...	55.4	3.8	59.8	6.3	66.2	5.3	73.4	4.1
12 ...	55.2	4.0	60.1	6.2	66.4	5.4	73.6	4.0
13 ...	55.0	4.2	60.2	6.3	66.7	5.3	73.8	3.9
14 ...	54.9	4.3	60.4	6.3	67.0	5.3	74.0	3.9
15 ...	54.8	4.4	60.5	6.3	67.2	5.3	74.1	3.9
16 ...	54.8	4.6	60.7	6.2	67.4	5.3	74.3	3.8
17 ...	54.8	4.7	60.9	6.1	67.6	5.4	74.3	3.9
18 ...	55.0	4.8	61.1	6.0	68.0	5.2	74.4	3.9
19 ...	55.2	4.8	61.3	6.0	68.3	5.2	74.5	3.9
20 ...	55.4	4.9	61.4	5.9	68.7	5.1	74.6	3.9
21 ...	55.6	5.0	61.6	5.9	69.1	4.9	74.7	3.9
22 ...	55.7	5.2	61.8	5.8	69.4	4.8	74.9	3.8
23 ...	55.9	5.2	62.0	5.8	69.8	4.6	75.1	3.7
24 ...	56.0	5.6	62.3	5.6	70.0	4.6	75.4	3.6
25 ...	56.1	5.8	62.5	5.6	70.3	4.5	75.6	3.6
26 ...	56.2	6.1	62.8	5.5	70.6	4.3	75.8	3.6
27 ...	56.4	6.1	63.0	5.5	70.8	4.3	76.0	3.6
28 ...	56.5	6.3	63.4	5.3	71.0	4.2	76.1	3.6
29 ...	56.7	6.3	...	...	71.2	4.2	76.1	3.6
30 ...	56.9	6.4	...	...	71.5	4.1	76.2	3.6
31 ...	57.0	6.5	...	...	71.7	4.1	...	...
Means...	55.8	4.8	60.3	6.1	67.6	5.0	74.1	3.9

## NOCTURNAL RADIATION.

DATE.	MAY.		JUNE.		JULY.		AUGUST.	
	Grass minimum therm.	Depression below dry minimum in shade.	Grass minimum therm.	Depression below dry minimum in shade.	Grass minimum therm.	Depression below dry minimum in shade.	Grass minimum therm.	Depression below dry minimum in shade.
1 ...	76.3	3.8	79.0	3.1	76.7	2.3	75.6	2.8
2 ...	76.5	3.7	78.9	3.1	76.6	2.3	75.6	2.8
3 ...	76.6	3.7	78.8	3.1	76.6	2.1	75.5	2.8
4 ...	76.8	3.6	78.7	3.1	76.5	2.1	75.5	2.8
5 ...	76.9	3.6	78.6	3.1	76.4	2.0	75.5	2.8
6 ...	77.1	3.5	78.5	3.1	76.3	2.0	75.5	2.8
7 ...	77.1	3.5	78.4	3.1	76.3	1.9	75.5	2.8
8 ...	77.2	3.4	78.3	3.1	76.2	1.9	75.6	2.7
9 ...	77.2	3.4	78.3	3.0	76.2	1.9	75.6	2.8
10 ...	77.2	3.5	78.2	2.9	76.2	2.0	75.6	2.9
11 ...	77.3	3.4	78.2	2.8	76.1	2.1	75.6	2.9
12 ...	77.3	3.4	78.2	2.7	76.1	2.0	75.6	2.9
13 ...	77.4	3.4	78.1	2.7	76.0	2.0	75.6	2.8
14 ...	77.4	3.5	78.0	2.7	76.0	1.9	75.6	2.7
15 ...	77.5	3.5	77.9	2.7	75.9	2.0	75.6	2.7
16 ...	77.6	3.5	77.8	2.7	75.9	2.0	75.6	2.7
17 ...	77.7	3.5	77.7	2.8	75.8	2.1	75.6	2.7
18 ...	77.7	3.6	77.6	2.8	75.8	2.2	75.7	2.5
19 ...	77.9	3.5	77.6	2.8	75.8	2.3	75.7	2.4
20 ...	78.0	3.5	77.5	2.8	75.8	2.4	75.8	2.3
21 ...	78.1	3.5	77.4	2.8	75.8	2.5	75.8	2.2
22 ...	78.2	3.5	77.3	2.7	75.8	2.6	75.7	2.2
23 ...	78.4	3.5	77.2	2.7	75.8	2.7	75.7	2.0
24 ...	78.5	3.6	77.1	2.6	75.7	2.8	75.7	1.9
25 ...	78.6	3.6	77.0	2.6	75.7	2.8	75.7	1.8
26 ...	78.6	3.6	76.9	2.6	75.6	2.8	75.7	1.7
27 ...	78.6	3.7	76.9	2.5	75.6	2.8	75.7	1.6
28 ...	78.7	3.6	76.8	2.5	75.6	2.9	75.7	1.6
29 ...	78.7	3.5	76.8	2.5	75.6	2.9	75.7	1.5
30 ...	78.8	3.4	76.7	2.5	75.6	2.9	75.7	1.5
31 ...	78.9	3.2	...	...	75.6	2.9	75.6	1.6
Means ...	77.7	3.5	77.8	2.8	76.0	2.3	75.6	2.4

## NOCTURNAL RADIATION.

DATE.	SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.	
	Grass minimum therm.	Depression below dry minimum in shade.	Grass minimum therm.	Depression below dry minimum in shade.	Grass minimum therm.	Depression below dry minimum in shade.	Grass minimum therm.	Depression below dry minimum in shade.
1 ...	75.6	1.6	73.7	2.3	68.3	2.1	59.8	5.6
2 ...	75.5	1.7	73.5	2.3	68.1	2.1	59.4	5.6
3 ...	75.5	1.7	73.3	2.4	67.9	2.1	59.1	5.6
4 ...	75.4	1.8	73.1	2.4	67.6	2.2	58.8	5.5
5 ...	75.4	1.8	72.9	2.4	67.3	2.3	58.5	5.4
6 ...	75.4	1.8	72.8	2.3	67.0	2.3	58.3	5.3
7 ...	75.4	1.8	72.6	2.3	66.6	2.6	58.2	5.2
8 ...	75.4	1.8	72.4	2.3	66.3	2.6	58.0	5.1
9 ...	75.4	1.8	72.2	2.3	65.9	3.1	58.1	4.8
10 ...	75.4	1.8	72.0	2.2	65.4	3.4	58.0	4.8
11 ...	75.3	2.0	71.9	2.1	65.0	3.6	58.0	4.6
12 ...	75.3	2.0	71.7	2.0	64.6	3.8	57.9	4.6
13 ...	75.2	2.1	71.5	1.9	64.2	4.0	57.9	4.4
14 ...	75.2	2.1	71.3	1.8	63.9	4.2	57.8	4.5
15 ...	75.2	2.0	71.1	1.8	63.6	4.3	57.8	4.4
16 ...	75.1	2.1	70.9	1.8	63.3	4.5	57.8	4.5
17 ...	75.1	2.1	70.7	1.8	63.1	4.6	57.8	4.7
18 ...	75.1	2.0	70.5	1.8	62.9	4.7	57.9	4.7
19 ...	75.0	2.0	70.3	1.8	62.7	4.9	57.9	4.8
20 ...	75.0	2.0	70.1	1.8	62.6	5.0	57.8	5.0
21 ...	74.9	2.0	69.9	1.9	62.4	5.1	57.7	5.2
22 ...	74.8	2.0	69.6	2.0	62.1	5.2	57.6	5.2
23 ...	74.7	2.1	69.4	2.1	61.9	5.2	57.4	5.3
24 ...	74.6	2.1	69.2	2.1	61.7	5.3	57.2	5.3
25 ...	74.6	2.0	69.1	2.0	61.6	5.3	57.1	5.1
26 ...	74.5	2.0	68.9	2.1	61.6	5.2	56.9	5.0
27 ...	74.4	2.0	68.8	2.1	61.1	5.6	56.7	4.9
28 ...	74.2	2.1	68.7	2.1	60.8	5.7	56.7	4.8
29 ...	74.1	2.2	68.6	2.1	60.5	5.7	56.8	4.6
30 ...	73.9	2.2	68.5	2.1	60.2	5.7	56.8	4.5
31 ...	...	...	68.5	2.0	...	...	56.8	4.3
Means ...	75.0	2.0	70.9	2.1	64.0	4.1	57.8	5.0

## WET BULB.

JANUARY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Wet Minimum.
1 ... ..	61.8	67.7	68.0	65.2	65.7	57.5
2 ... ..	61.8	67.8	68.1	65.2	65.7	57.4
3 ... ..	61.8	67.9	68.2	65.2	65.8	57.4
4 ... ..	61.7	68.0	68.3	65.2	65.8	57.4
5 ... ..	61.7	68.0	68.3	65.2	65.8	57.3
6 ... ..	61.7	68.0	68.4	65.1	65.8	57.3
7 ... ..	61.6	68.1	68.4	65.1	65.8	57.2
8 ... ..	61.6	68.1	68.5	65.1	65.8	57.1
9 ... ..	61.6	68.2	68.6	65.1	65.9	57.1
10 ... ..	61.6	68.3	68.6	65.2	65.9	57.1
11 ... ..	61.6	68.4	68.7	65.2	66.0	57.1
12 ... ..	61.7	68.5	68.8	65.3	66.1	57.2
13 ... ..	61.7	68.5	68.8	65.3	66.1	57.2
14 ... ..	61.7	68.6	68.9	65.4	66.2	57.2
15 ... ..	61.7	68.7	69.0	65.4	66.2	57.3
16 ... ..	61.8	68.7	69.1	65.5	66.3	57.3
17 ... ..	62.0	68.9	69.2	65.7	66.5	57.4
18 ... ..	62.1	69.0	69.3	65.8	66.6	57.6
19 ... ..	62.3	69.1	69.4	66.0	66.7	57.7
20 ... ..	62.5	69.1	69.5	66.2	66.8	57.9
21 ... ..	62.7	69.2	69.5	66.3	66.9	58.1
22 ... ..	62.9	69.3	69.6	66.5	67.1	58.2
23 ... ..	63.1	69.4	69.7	66.7	67.2	58.4
24 ... ..	63.3	69.5	69.8	66.8	67.4	58.6
25 ... ..	63.4	69.6	69.8	66.9	67.4	58.8
26 ... ..	63.6	69.7	69.9	67.0	67.6	58.9
27 ... ..	63.7	69.7	70.0	67.1	67.6	59.0
28 ... ..	63.9	69.7	70.1	67.2	67.7	59.2
29 ... ..	64.0	69.8	70.2	67.4	67.9	59.3
30 ... ..	64.2	69.9	70.3	67.5	68.0	59.5
31 ... ..	64.3	69.9	70.4	67.6	68.1	59.7
Mean ...	62.4	68.8	69.1	65.9	66.6	57.9

## WET BULB.

FEBRUARY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Wet Minimum.
1 ... ..	64.5	70.0	70.5	67.7	68.2	59.8
2 ... ..	64.6	70.1	70.6	67.8	68.3	60.0
3 ... ..	64.7	70.2	70.7	68.0	68.4	60.2
4 ... ..	64.9	70.4	70.9	68.2	68.6	60.4
5 ... ..	65.1	70.5	71.1	68.4	68.8	60.7
6 ... ..	65.2	70.7	71.3	68.6	69.0	60.9
7 ... ..	65.4	70.9	71.4	68.7	69.1	61.1
8 ... ..	65.6	71.0	71.5	68.9	69.3	61.4
9 ... ..	65.8	71.2	71.7	69.1	69.5	61.6
10 ... ..	66.0	71.3	71.9	69.3	69.6	61.9
11 ... ..	66.2	71.5	72.0	69.5	69.8	62.1
12 ... ..	66.3	71.6	72.0	69.6	69.9	62.3
13 ... ..	66.4	71.7	72.1	69.7	70.0	62.5
14 ... ..	66.6	71.8	72.1	69.8	70.1	62.7
15 ... ..	66.7	71.9	72.1	69.9	70.2	62.8
16 ... ..	66.8	72.0	72.2	70.0	70.3	63.0
17 ... ..	67.0	72.1	72.3	70.1	70.4	63.2
18 ... ..	67.1	72.1	72.3	70.3	70.5	63.4
19 ... ..	67.3	72.2	72.4	70.4	70.6	63.5
20 ... ..	67.4	72.3	72.4	70.5	70.7	63.7
21 ... ..	67.5	72.3	72.5	70.6	70.7	63.8
22 ... ..	67.7	72.4	72.6	70.7	70.9	64.0
23 ... ..	67.8	72.5	72.7	70.8	71.0	64.1
24 ... ..	68.0	72.5	72.8	71.0	71.1	64.3
25 ... ..	68.1	72.6	72.9	71.1	71.2	64.4
26 ... ..	68.2	72.6	73.1	71.2	71.3	64.6
27 ... ..	68.4	72.7	73.2	71.3	71.4	64.8
28 ... ..	68.5	72.9	73.4	71.5	71.6	65.0
Means ...	66.6	71.6	72.0	69.7	70.0	62.6

## WET BULB.

MARCH.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Wet Minimum.
1 ... ..	68.8	78.0	73.6	71.7	71.8	65.2
2 ... ..	69.0	78.2	73.8	71.9	72.0	65.4
3 ... ..	69.2	78.3	73.9	72.1	72.1	65.6
4 ... ..	69.3	78.4	74.0	72.2	72.2	65.8
5 ... ..	69.5	78.6	74.1	72.3	72.4	66.0
6 ... ..	69.7	78.7	74.2	72.5	72.5	66.2
7 ... ..	69.9	78.8	74.4	72.6	72.7	66.4
8 ... ..	70.1	78.9	74.5	72.8	72.8	66.6
9 ... ..	70.3	74.0	74.6	73.0	73.0	66.8
10 ... ..	70.5	74.2	74.7	73.1	73.1	67.0
11 ... ..	70.8	74.4	74.9	73.3	73.4	67.2
12 ... ..	71.0	74.5	75.0	73.5	73.5	67.3
13 ... ..	71.3	74.7	75.1	73.6	73.7	67.7
14 ... ..	71.5	74.9	75.2	73.8	73.9	67.9
15 ... ..	71.7	75.0	75.3	74.0	74.0	68.1
16 ... ..	71.9	75.1	75.4	74.1	74.1	68.3
17 ... ..	72.1	75.2	75.6	74.2	74.3	68.5
18 ... ..	72.3	75.3	75.7	74.4	74.4	68.7
19 ... ..	72.5	75.5	76.0	74.6	74.7	68.9
20 ... ..	72.7	75.7	76.1	74.8	74.8	69.2
21 ... ..	72.9	75.8	76.3	74.9	75.0	69.4
22 ... ..	73.1	76.0	76.5	75.1	75.2	69.6
23 ... ..	73.3	76.2	76.6	75.2	75.3	69.8
24 ... ..	73.4	76.3	76.7	75.3	75.4	70.0
25 ... ..	73.5	76.4	76.8	75.4	75.5	70.1
26 ... ..	73.6	76.5	76.9	75.5	75.6	70.2
27 ... ..	73.7	76.5	76.9	75.6	75.7	70.3
28 ... ..	73.8	76.6	77.0	75.7	75.8	70.4
29 ... ..	73.9	76.6	77.1	75.8	75.9	70.6
30 ... ..	74.0	76.7	77.2	75.9	76.0	70.7
31 ... ..	74.1	76.9	77.2	76.0	76.1	70.8
Means ...	71.7	75.1	75.5	74.0	74.1	68.2



## WET BULB.

APRIL.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Wet Minimum.
1 ... ..	74.2	77.0	77.3	76.0	76.1	70.9
2 ... ..	74.3	77.1	77.3	76.1	76.2	71.0
3 ... ..	74.4	77.2	77.4	76.2	76.3	71.1
4 ... ..	74.6	77.3	77.5	76.3	76.4	71.3
5 ... ..	74.7	77.3	77.6	76.4	76.5	71.4
6 ... ..	74.8	77.4	77.7	76.5	76.6	71.4
7 ... ..	74.9	77.5	77.8	76.6	76.7	71.5
8 ... ..	75.1	77.6	77.9	76.7	76.8	71.6
9 ... ..	75.2	77.7	78.0	76.7	76.9	71.7
10 ... ..	75.3	77.8	78.1	76.8	77.0	71.8
11 ... ..	75.3	77.9	78.1	76.8	77.0	71.9
12 ... ..	75.4	77.9	78.2	76.9	77.1	72.0
13 ... ..	75.5	78.0	78.3	76.9	77.2	72.1
14 ... ..	75.6	78.1	78.4	77.0	77.3	72.2
15 ... ..	75.7	78.2	78.5	77.1	77.4	72.3
16 ... ..	75.8	78.2	78.6	77.1	77.4	72.3
17 ... ..	75.9	78.3	78.7	77.2	77.5	72.4
18 ... ..	75.9	78.3	78.7	77.2	77.5	72.5
19 ... ..	76.0	78.4	78.8	77.3	77.6	72.6
20 ... ..	76.0	78.4	78.8	77.3	77.6	72.6
21 ... ..	76.1	78.5	78.9	77.4	77.7	72.7
22 ... ..	76.1	78.6	79.0	77.5	77.8	72.8
23 ... ..	76.2	78.7	79.1	77.6	77.9	72.9
24 ... ..	76.3	78.8	79.2	77.7	78.0	73.1
25 ... ..	76.4	78.8	79.3	77.8	78.1	73.2
26 ... ..	76.5	79.0	79.4	77.9	78.2	73.3
27 ... ..	76.6	79.1	79.5	78.0	78.3	73.4
28 ... ..	76.7	79.1	79.5	78.1	78.4	73.5
29 ... ..	76.8	79.2	79.6	78.1	78.4	73.5
30 ... ..	76.9	79.3	79.7	78.2	78.5	73.6
Means ...	75.6	78.1	78.5	77.1	77.3	72.3

## WET BULB.

MAY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Wet Minimum.
1 ... ..	77.0	79.4	79.8	78.8	78.6	73.7
2 ... ..	77.2	79.5	79.8	78.4	78.7	73.7
3 ... ..	77.3	79.6	79.9	78.4	78.8	73.7
4 ... ..	77.3	79.7	79.9	78.5	78.9	73.7
5 ... ..	77.4	79.8	80.0	78.6	79.0	73.8
6 ... ..	77.5	79.8	80.0	78.6	79.0	73.8
7 ... ..	77.6	79.9	80.1	78.7	79.1	73.9
8 ... ..	77.6	79.9	80.1	78.7	79.1	73.9
9 ... ..	77.7	80.0	80.1	78.8	79.2	73.9
10 ... ..	77.7	80.0	80.1	78.8	79.2	74.0
11 ... ..	77.8	80.1	80.2	78.9	79.3	74.0
12 ... ..	77.9	80.1	80.2	78.9	79.3	74.1
13 ... ..	78.0	80.2	80.3	79.0	79.4	74.2
14 ... ..	78.1	80.3	80.4	79.1	79.5	74.2
15 ... ..	78.1	80.4	80.5	79.1	79.5	74.3
16 ... ..	78.2	80.5	80.6	79.2	79.6	74.4
17 ... ..	78.3	80.5	80.6	79.2	79.7	74.5
18 ... ..	78.4	80.6	80.7	79.3	79.8	74.6
19 ... ..	78.6	80.7	80.8	79.3	79.9	74.7
20 ... ..	78.6	80.7	80.8	79.4	79.9	74.8
21 ... ..	78.7	80.8	80.9	79.4	80.0	74.9
22 ... ..	78.8	80.9	81.0	79.5	80.1	74.9
23 ... ..	78.8	80.9	81.1	79.5	80.1	75.0
24 ... ..	78.9	81.0	81.1	79.5	80.1	75.0
25 ... ..	78.9	81.0	81.1	79.5	80.1	75.0
26 ... ..	79.0	80.9	81.1	79.6	80.2	75.0
27 ... ..	79.0	80.9	81.2	79.6	80.2	75.1
28 ... ..	79.0	80.9	81.2	79.6	80.2	75.1
29 ... ..	79.0	80.9	81.1	79.6	80.2	75.1
30 ... ..	79.0	80.9	81.0	79.6	80.1	75.1
31 ... ..	79.0	80.8	81.0	79.5	80.1	75.1
Means ...	78.2	80.4	80.5	79.3	79.6	74.4

## WET BULB.

JUNE.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Wet Minimum.
1 ... ..	79.0	80.8	80.9	79.5	80.1	75.1
2 ... ..	78.9	80.7	80.8	79.4	80.0	75.1
3 ... ..	78.8	80.6	80.7	79.4	79.9	75.1
4 ... ..	78.8	80.5	80.6	79.3	79.8	75.0
5 ... ..	78.7	80.4	80.5	79.2	79.7	74.9
6 ... ..	78.6	80.3	80.4	79.2	79.6	74.9
7 ... ..	78.5	80.2	80.4	79.1	79.6	74.9
8 ... ..	78.4	80.2	80.3	79.0	79.5	74.8
9 ... ..	78.3	80.1	80.2	78.9	79.4	74.6
10 ... ..	78.2	80.0	80.1	78.8	79.3	74.7
11 ... ..	78.1	79.9	80.0	78.8	79.2	74.7
12 ... ..	78.0	79.8	79.9	78.7	79.1	74.7
13 ... ..	77.9	79.7	79.8	78.5	79.0	74.6
14 ... ..	77.7	79.6	79.7	78.4	78.9	74.5
15 ... ..	77.6	79.5	79.6	78.3	78.8	74.4
16 ... ..	77.5	79.4	79.6	78.2	78.7	74.3
17 ... ..	77.4	79.3	79.5	78.2	78.6	74.2
18 ... ..	77.3	79.2	79.4	78.1	78.5	74.2
19 ... ..	77.2	79.1	79.3	78.0	78.4	74.1
20 ... ..	77.1	79.1	79.2	77.9	78.3	74.0
21 ... ..	77.0	79.0	79.1	77.9	78.3	73.9
22 ... ..	76.9	79.0	79.0	77.8	78.2	73.8
23 ... ..	76.8	79.0	79.0	77.8	78.2	73.7
24 ... ..	76.8	78.9	78.9	77.7	78.1	73.6
25 ... ..	76.7	78.9	78.9	77.7	78.1	73.6
26 ... ..	76.6	78.9	78.9	77.6	78.0	73.3
27 ... ..	76.6	78.8	78.8	77.6	78.0	73.2
28 ... ..	76.5	78.8	78.8	77.6	77.9	73.1
29 ... ..	76.5	78.8	78.8	77.6	77.9	73.0
30 ... ..	76.5	78.8	78.9	77.6	78.0	72.9
Means ...	77.6	79.6	79.7	78.4	78.3	74.2

## WET BULB.

JULY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Wet Minimum.
1 ... ..	78.4	78.8	78.9	77.6	77.9	72.9
2 ... ..	78.4	78.8	78.9	77.6	77.9	72.8
3 ... ..	78.4	78.8	78.9	77.6	77.9	72.7
4 ... ..	78.3	78.8	78.9	77.4	77.9	72.6
5 ... ..	78.3	78.7	78.8	77.4	77.8	72.5
6 ... ..	78.2	78.7	78.8	77.4	77.8	72.4
7 ... ..	78.2	78.6	78.8	77.3	77.7	72.4
8 ... ..	78.2	78.6	78.8	77.3	77.7	72.3
9 ... ..	78.1	78.5	78.8	77.2	77.7	72.3
10 ... ..	78.1	78.5	78.7	77.2	77.6	72.3
11 ... ..	78.1	78.4	78.7	77.2	77.6	72.2
12 ... ..	78.0	78.4	78.6	77.1	77.5	72.2
13 .. ...	78.0	78.3	78.6	77.0	77.5	72.2
14 ... ..	78.9	78.2	78.6	77.0	77.5	72.2
15 ... ..	78.9	78.2	78.5	77.0	77.4	72.2
16 ... ..	78.9	78.2	78.5	76.9	77.4	72.2
17 ... ..	78.9	78.2	78.4	76.9	77.4	72.2
18 ... ..	78.8	78.2	78.4	76.9	77.3	72.2
19 ... ..	78.8	78.2	78.4	76.9	77.3	72.2
20 ... ..	78.9	78.2	78.4	76.9	77.4	72.2
21 ... ..	78.9	78.2	78.4	76.9	77.4	72.2
22 ... ..	78.9	78.2	78.5	76.9	77.4	72.2
23 ... ..	78.9	78.2	78.5	76.9	77.4	72.2
24 ... ..	78.9	78.2	78.5	76.9	77.4	72.2
25 ... ..	78.9	78.2	78.5	76.9	77.4	72.2
26 ... ..	78.0	78.2	78.6	77.0	77.5	72.2
27 ... ..	78.0	78.3	78.6	77.0	77.5	72.2
28 ... ..	78.0	78.3	78.7	77.1	77.5	72.2
29 ... ..	78.1	78.3	78.8	77.1	77.6	72.4
30 ... ..	78.2	78.4	78.8	77.2	77.7	72.4
31 ... ..	78.2	78.4	78.9	77.2	77.7	72.4
Means ...	78.1	78.4	78.7	77.1	77.6	72.3

## WET BULB.

AUGUST.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Wet Minimum.
1 ... ..	78.3	78.4	78.9	77.3	77.7	72.4
2 ... ..	78.4	78.5	79.0	77.4	77.8	72.4
3 ... ..	78.4	78.5	79.0	77.4	77.8	72.4
4 ... ..	78.4	78.5	79.1	77.4	77.9	72.5
5 ... ..	78.5	78.5	79.1	77.4	77.9	72.5
6 ... ..	78.5	78.6	79.1	77.5	77.9	72.5
7 ... ..	78.5	78.6	79.2	77.5	78.0	72.6
8 ... ..	78.5	78.6	79.1	77.5	77.9	72.6
9 ... ..	78.5	78.6	79.1	77.5	77.9	72.7
10 ... ..	78.5	78.6	79.1	77.6	78.0	72.7
11 ... ..	78.5	78.7	79.1	77.6	78.0	72.8
12 ... ..	78.5	78.7	79.0	77.5	77.9	72.8
13 ... ..	78.5	78.7	79.0	77.5	77.9	72.8
14 ... ..	78.4	78.7	79.0	77.5	77.9	72.8
15 ... ..	78.4	78.7	79.0	77.5	77.9	72.9
16 ... ..	78.4	78.7	79.0	77.5	77.9	72.9
17 ... ..	78.4	78.7	79.0	77.5	77.9	72.9
18 ... ..	78.3	78.7	79.0	77.5	77.9	73.0
19 ... ..	78.3	78.8	79.0	77.5	77.9	73.0
20 ... ..	78.4	78.8	79.0	77.5	77.9	73.0
21 ... ..	78.4	78.8	78.9	77.5	77.9	73.0
22 ... ..	78.4	78.8	78.9	77.5	77.9	73.0
23 ... ..	78.4	78.9	78.9	77.5	77.9	73.0
24 ... ..	78.4	78.9	78.9	77.5	77.9	73.0
25 ... ..	78.4	78.9	78.9	77.5	77.9	73.0
26 ... ..	78.4	78.8	78.9	77.5	77.9	72.9
27 ... ..	78.4	78.8	78.8	77.5	77.9	72.9
28 ... ..	78.4	78.8	78.8	77.5	77.9	72.8
29 ... ..	78.4	78.8	78.8	77.5	77.9	72.8
30 ... ..	78.4	78.8	78.7	77.5	77.9	72.8
31 ... ..	78.4	78.8	78.7	77.5	77.9	72.7
Means ...	78.4	78.7	79.0	77.5	77.9	72.8

## WET BULB.

SEPTEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Wet Minimum.
1 ... ..	76.4	78.7	78.7	77.5	77.8	72.7
2 ... ..	76.4	78.7	78.6	77.5	77.8	72.7
3 ... ..	76.4	78.7	78.6	77.5	77.8	72.7
4 ... ..	76.4	78.6	78.6	77.5	77.8	72.6
5 ... ..	76.5	78.7	78.7	77.6	77.9	72.6
6 ... ..	76.5	78.7	78.7	77.6	77.9	72.6
7 ... ..	76.5	78.7	78.7	77.6	77.9	72.6
8 ... ..	76.6	78.7	78.7	77.6	77.9	72.6
9 ... ..	76.6	78.7	78.8	77.6	77.9	72.6
10 ... ..	76.6	78.7	78.9	77.7	78.0	72.7
11 ... ..	76.6	78.8	78.9	77.7	78.0	72.7
12 ... ..	76.7	78.8	78.9	77.7	78.0	72.7
13 ... ..	76.7	78.8	79.0	77.7	78.1	72.7
14 ... ..	76.7	78.9	79.0	77.7	78.1	72.7
15 ... ..	76.7	78.9	79.0	77.8	78.1	72.8
16 ... ..	76.7	78.9	79.0	77.8	78.1	72.8
17 ... ..	76.7	78.9	79.0	77.7	78.1	72.7
18 ... ..	76.7	78.9	79.0	77.7	78.1	72.7
19 ... ..	76.7	78.9	79.0	77.6	78.1	72.7
20 ... ..	76.8	78.9	78.9	77.6	78.0	72.6
21 ... ..	76.6	78.9	78.9	77.5	78.0	72.6
22 ... ..	76.5	78.9	78.9	77.4	77.9	72.6
23 ... ..	76.5	78.9	78.9	77.4	77.9	72.5
24 ... ..	76.4	78.9	78.8	77.4	77.9	72.5
25 ... ..	76.4	78.9	78.8	77.3	77.9	72.5
26 ... ..	76.3	79.0	78.7	77.3	77.8	72.4
27 ... ..	76.2	79.0	78.7	77.2	77.8	72.3
28 ... ..	76.2	79.0	78.7	77.1	77.8	72.2
29 ... ..	76.1	79.0	78.7	77.1	77.7	72.1
30 ... ..	76.0	78.9	78.6	77.0	77.6	72.1
Means ...	76.5	78.8	78.8	77.5	77.9	72.6

## WET BULB.

OCTOBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Wet Minimum.
1 ... ..	75.9	78.9	78.6	76.9	77.6	72.0
2 ... ..	75.7	78.9	78.5	76.9	77.5	71.9
3 ... ..	75.6	78.8	78.5	76.8	77.4	71.7
4 ... ..	75.5	78.7	78.4	76.7	77.3	71.6
5 ... ..	75.4	78.7	78.3	76.6	77.3	71.4
6 ... ..	75.2	78.6	78.2	76.5	77.1	71.3
7 ... ..	75.0	78.5	78.1	76.4	77.0	71.1
8 ... ..	74.9	78.4	78.0	76.4	76.9	70.9
9 ... ..	74.8	78.3	77.9	76.3	76.8	70.7
10 ... ..	74.6	78.1	77.8	76.1	76.7	70.6
11 ... ..	74.5	78.0	77.7	76.0	76.6	70.4
12 ... ..	74.3	77.8	77.6	75.9	76.4	70.3
13 ... ..	74.2	77.6	77.4	75.7	76.2	70.1
14 ... ..	74.0	77.5	77.3	75.6	76.1	69.9
15 ... ..	73.8	77.3	77.1	75.4	75.9	69.7
16 ... ..	73.6	77.2	77.0	75.2	75.8	69.5
17 ... ..	73.4	77.0	76.9	75.1	75.6	69.3
18 ... ..	73.2	76.9	76.8	74.9	75.5	69.2
19 ... ..	73.0	76.8	76.7	74.8	75.3	69.0
20 ... ..	72.9	76.7	76.6	74.6	75.2	68.9
21 ... ..	72.7	76.5	76.5	74.5	75.1	68.7
22 ... ..	72.5	76.3	76.3	74.3	74.9	68.5
23 ... ..	72.3	76.1	76.1	74.1	74.7	68.3
24 ... ..	72.1	76.0	76.0	73.8	74.5	68.1
25 ... ..	71.8	75.8	75.8	73.6	74.3	67.9
26 ... ..	71.6	75.6	75.7	73.5	74.1	67.7
27 ... ..	71.4	75.4	75.6	73.3	73.9	67.6
28 ... ..	71.2	75.3	75.5	73.2	73.8	67.4
29 ... ..	71.0	75.1	75.4	73.0	73.6	67.2
30 ... ..	70.9	74.9	75.2	72.9	73.5	67.1
31 ... ..	70.8	74.8	75.1	72.8	73.4	67.0
Means ...	73.5	77.1	77.0	75.1	75.7	69.5

## WET BULB.

NOVEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Wet Minimum.
1 ... ..	70.7	74.6	75.0	72.8	73.3	66.8
2 ... ..	70.6	74.5	74.8	72.6	73.1	66.7
3 ... ..	70.5	74.3	74.7	72.5	73.0	66.6
4 ... ..	70.4	74.1	74.5	72.4	72.9	66.4
5 ... ..	70.2	73.9	74.3	72.2	72.7	66.2
6 ... ..	70.0	73.6	74.1	72.0	72.4	66.0
7 ... ..	69.8	73.3	73.8	71.8	72.2	65.8
8 ... ..	69.6	73.0	73.6	71.6	72.0	65.6
9 ... ..	69.5	72.7	73.3	71.4	71.7	65.3
10 ... ..	69.3	72.4	73.1	71.2	71.5	65.1
11 ... ..	69.1	72.1	72.8	70.9	71.2	64.9
12 ... ..	68.8	71.8	72.6	70.7	71.0	64.7
13 ... ..	68.6	71.6	72.4	70.5	70.8	64.5
14 ... ..	68.4	71.4	72.2	70.3	70.6	64.3
15 ... ..	68.2	71.1	71.9	70.0	70.3	64.1
16 ... ..	67.9	70.8	71.7	69.8	70.1	63.9
17 ... ..	67.7	70.6	71.4	69.6	69.8	63.7
18 ... ..	67.5	70.5	71.3	69.4	69.7	63.6
19 ... ..	67.4	70.3	71.1	69.3	69.5	63.4
20 ... ..	67.2	70.2	71.0	69.1	69.4	63.3
21 ... ..	67.1	70.1	70.8	69.0	69.3	63.2
22 ... ..	66.9	70.1	70.7	68.8	69.1	63.1
23 ... ..	66.7	70.0	70.6	68.6	69.0	62.9
24 ... ..	66.5	69.9	70.5	68.5	68.9	62.8
25 ... ..	66.3	69.8	70.4	68.3	68.7	62.6
26 ... ..	66.2	69.8	70.3	68.2	68.6	62.4
27 ... ..	66.0	69.7	70.2	68.0	68.5	62.2
28 ... ..	65.8	69.6	70.1	67.9	68.4	62.0
29 ... ..	65.5	69.5	69.9	67.7	68.2	61.7
30 ... ..	65.3	69.4	69.8	67.5	68.0	61.5
Means ...	68.1	71.5	72.1	70.1	70.5	64.2



## WET BULB.

DECEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Wet Minimum.
1 ... ..	65.1	69.3	69.7	67.3	67.9	61.3
2 ... ..	64.8	69.2	69.5	67.1	67.7	60.9
3 ... ..	64.5	69.0	69.4	66.9	67.5	60.6
4 ... ..	64.2	68.9	69.2	66.7	67.3	60.3
5 ... ..	63.9	68.8	69.2	66.6	67.1	60.0
6 ... ..	63.7	68.7	69.1	66.5	67.0	59.8
7 ... ..	63.6	68.7	69.1	66.4	67.0	59.6
8 ... ..	63.4	68.6	69.0	66.4	66.9	59.4
9 ... ..	63.3	68.6	68.9	66.3	66.8	59.3
10 ... ..	63.2	68.5	68.9	66.3	66.7	59.2
11 ... ..	63.1	68.3	68.8	66.2	66.6	59.0
12 ... ..	63.0	68.2	68.6	66.1	66.5	58.9
13 ... ..	62.8	68.0	68.5	66.0	66.3	58.8
14 ... ..	62.7	67.9	68.4	65.9	66.2	58.7
15 ... ..	62.6	67.8	68.3	65.8	66.1	58.6
16 ... ..	62.5	67.7	68.2	65.7	66.0	58.5
17 ... ..	62.4	67.6	68.1	65.7	66.0	58.4
18 ... ..	62.4	67.5	68.0	65.6	65.9	58.3
19 ... ..	62.3	67.4	67.9	65.5	65.8	58.2
20 ... ..	62.2	67.3	67.8	65.4	65.7	58.1
21 ... ..	62.1	67.2	67.7	65.3	65.6	58.0
22 ... ..	62.0	67.2	67.7	65.2	65.5	57.9
23 ... ..	61.9	67.1	67.6	65.1	65.4	57.8
24 ... ..	61.8	67.1	67.6	65.1	65.4	57.7
25 ... ..	61.8	67.1	67.5	65.0	65.4	57.6
26 ... ..	61.7	67.1	67.5	65.0	65.3	57.5
27 ... ..	61.6	67.2	67.6	65.0	65.4	57.5
28 ... ..	61.6	67.2	67.7	65.0	65.4	57.4
29 ... ..	61.7	67.4	67.8	65.1	65.5	57.5
30 ... ..	61.8	67.5	67.9	65.2	65.6	57.5
31 ... ..	61.8	67.6	68.0	65.2	65.7	57.5
Means ...	62.8	67.9	68.4	65.8	66.2	58.7

## VAPOUR PRESSURE.

JANUARY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	520	558	556	568	551
2 ... ..	522	561	559	568	553
3 ... ..	523	564	562	571	555
4 ... ..	521	567	566	572	557
5 ... ..	523	566	565	574	557
6 ... ..	524	565	567	571	557
7 ... ..	522	568	567	571	557
8 ... ..	523	567	568	573	558
9 ... ..	524	569	573	578	560
10 ... ..	524	572	572	578	562
11 ... ..	525	574	573	578	563
12 ... ..	529	576	574	580	565
13 ... ..	529	575	573	580	564
14 ... ..	529	578	576	582	566
15 ... ..	529	581	579	581	568
16 ... ..	532	579	581	584	569
17 ... ..	537	585	584	588	574
18 ... ..	538	588	586	590	576
19 ... ..	543	590	588	594	579
20 ... ..	547	589	591	596	581
21 ... ..	551	592	589	599	583
22 ... ..	555	594	592	604	586
23 ... ..	559	598	594	606	590
24 ... ..	563	600	597	609	592
25 ... ..	564	603	595	610	593
26 ... ..	569	605	598	612	596
27 ... ..	569	604	601	613	597
28 ... ..	573	603	604	616	599
29 ... ..	574	605	606	620	601
30 ... ..	578	608	609	623	605
31 ... ..	579	608	611	624	606
Means ...	542	584	582	592	575

## VAPOUR PRESSURE.

FEBRUARY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	·583	·608	·614	·626	·608
2 ... ..	·584	·611	·616	·628	·610
3 ... ..	·584	·612	·619	·633	·612
4 ... ..	·589	·618	·625	·633	·618
5 ... ..	·593	·621	·632	·642	·622
6 ... ..	·595	·626	·637	·647	·626
7 ... ..	·597	·622	·640	·649	·627
8 ... ..	·601	·633	·648	·652	·632
9 ... ..	·605	·640	·649	·657	·638
10 ... ..	·608	·641	·654	·662	·641
11 ... ..	·613	·648	·657	·667	·646
12 ... ..	·614	·649	·654	·669	·647
13 ... ..	·616	·652	·657	·670	·649
14 ... ..	·621	·654	·656	·672	·651
15 ... ..	·622	·655	·653	·674	·651
16 ... ..	·624	·658	·654	·674	·653
17 ... ..	·629	·660	·656	·675	·655
18 ... ..	·631	·657	·654	·681	·656
19 ... ..	·636	·659	·656	·683	·659
20 ... ..	·638	·660	·654	·685	·659
21 ... ..	·639	·657	·656	·686	·660
22 ... ..	·643	·658	·657	·687	·661
23 ... ..	·644	·659	·658	·688	·662
24 ... ..	·650	·657	·661	·694	·666
25 ... ..	·651	·658	·662	·696	·667
26 ... ..	·652	·656	·669	·698	·669
27 ... ..	·658	·657	·672	·699	·672
28 ... ..	·659	·664	·679	·705	·677
Means ...	·621	·645	·650	·669	·646

## VAPOUR PRESSURE.

MARCH.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	·667	·664	·685	·708	·681
2 ... ..	·671	·671	·694	·714	·688
3 ... ..	·676	·678	·678	·720	·692
4 ... ..	·678	·677	·700	·722	·694
5 ... ..	·681	·684	·705	·723	·698
6 ... ..	·686	·687	·708	·730	·703
7 ... ..	·690	·689	·716	·731	·707
8 ... ..	·695	·692	·719	·738	·711
9 ... ..	·698	·695	·723	·745	·715
10 ... ..	·703	·704	·727	·746	·720
11 ... ..	·712	·711	·735	·753	·723
12 ... ..	·716	·714	·739	·759	·732
13 ... ..	·725	·721	·742	·761	·737
14 ... ..	·729	·727	·745	·767	·742
15 ... ..	·734	·729	·748	·773	·746
16 ... ..	·739	·731	·749	·775	·749
17 ... ..	·744	·734	·757	·777	·753
18 ... ..	·750	·735	·760	·784	·757
19 ... ..	·757	·741	·771	·789	·765
20 ... ..	·762	·748	·774	·796	·770
21 ... ..	·768	·747	·781	·799	·774
22 ... ..	·774	·757	·788	·807	·782
23 ... ..	·780	·764	·790	·809	·786
24 ... ..	·783	·767	·793	·812	·789
25 ... ..	·784	·769	·796	·815	·791
26 ... ..	·787	·772	·798	·818	·794
27 ... ..	·788	·771	·797	·821	·794
28 ... ..	·791	·772	·798	·824	·796
29 ... ..	·793	·771	·801	·827	·798
30 ... ..	·795	·774	·804	·830	·801
31 ... ..	·797	·781	·803	·834	·804
Means ...	·727	·723	·753	·774	·743

## VAPOUR PRESSURE.

APRIL.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	798	784	808	833	806
2 ... ..	801	797	806	837	806
3 ... ..	802	790	809	840	810
4 ... ..	809	792	812	842	814
5 ... ..	811	791	815	845	816
6 ... ..	814	792	820	850	819
7 ... ..	815	794	823	853	821
8 ... ..	823	798	826	856	826
9 ... ..	826	801	829	855	828
10 ... ..	827	802	834	859	831
11 ... ..	826	806	834	859	831
12 ... ..	830	804	838	862	834
13 ... ..	833	807	843	862	836
14 ... ..	836	809	848	866	840
15 ... ..	839	809	851	869	842
16 ... ..	842	810	855	867	844
17 ... ..	845	815	859	871	848
18 ... ..	844	818	858	871	847
19 ... ..	846	816	862	874	850
20 ... ..	845	815	862	873	849
21 ... ..	848	820	867	876	852
22 ... ..	847	822	870	879	855
23 ... ..	850	826	874	882	858
24 ... ..	853	829	877	884	861
25 ... ..	856	829	881	887	863
26 ... ..	857	837	884	890	867
27 ... ..	860	841	889	892	871
28 ... ..	863	841	888	895	872
29 ... ..	866	846	892	893	874
30 ... ..	868	851	895	897	878
Mean ...	836	818	850	867	842

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VAPOUR PRESSURE.

MAY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	·871	·854	·900	·900	·881
2 ... ..	·878	·858	·899	·903	·885
3 ... ..	·882	·863	·903	·902	·888
4 ... ..	·880	·868	·902	·906	·889
5 ... ..	·883	·872	·904	·909	·892
6 ... ..	·887	·872	·903	·909	·893
7 ... ..	·891	·877	·908	·914	·898
8 ... ..	·889	·877	·906	·914	·897
9 ... ..	·894	·882	·906	·917	·900
10 ... ..	·888	·882	·904	·917	·897
11 ... ..	·896	·886	·908	·920	·903
12 ... ..	·900	·885	·906	·920	·903
13 ... ..	·908	·888	·908	·924	·906
14 ... ..	·906	·898	·911	·927	·909
15 ... ..	·905	·898	·915	·926	·911
16 ... ..	·908	·911	·918	·930	·917
17 ... ..	·911	·911	·918	·930	·918
18 ... ..	·916	·906	·923	·935	·920
19 ... ..	·924	·911	·916	·934	·921
20 ... ..	·922	·912	·925	·938	·924
21 ... ..	·927	·917	·929	·937	·928
22 ... ..	·930	·921	·933	·940	·931
23 ... ..	·929	·921	·936	·939	·931
24 ... ..	·932	·925	·938	·939	·934
25 ... ..	·931	·927	·939	·937	·934
26 ... ..	·936	·922	·939	·942	·935
27 ... ..	·936	·923	·945	·942	·937
28 ... ..	·936	·923	·945	·942	·937
29 ... ..	·934	·923	·945	·941	·936
30 ... ..	·934	·923	·937	·941	·934
31 ... ..	·934	·920	·938	·936	·932
Means ...	·909	·898	·920	·926	·913

## VAPOUR PRESSURE.

JUNE.

DATE.	4 Hrs.	10 Hrs.	15 Hrs.	25 Hrs.	Mean.
1 ... ..	934	920	935	936	931
2 ... ..	929	917	932	931	927
3 ... ..	925	913	928	933	925
4 ... ..	925	910	923	928	922
5 ... ..	922	908	920	923	918
6 ... ..	918	904	915	925	916
7 ... ..	914	901	917	921	913
8 ... ..	911	902	912	918	911
9 ... ..	908	899	909	913	907
10 ... ..	904	896	904	910	904
11 ... ..	900	894	901	912	902
12 ... ..	897	890	897	908	896
13 ... ..	895	888	894	901	895
14 ... ..	897	885	889	897	890
15 ... ..	884	881	885	894	886
16 ... ..	881	877	885	891	884
17 ... ..	878	874	881	892	881
18 ... ..	875	871	876	889	878
19 ... ..	873	867	871	886	874
20 ... ..	870	869	868	883	872
21 ... ..	868	865	865	884	871
22 ... ..	865	867	861	881	869
23 ... ..	862	870	864	883	870
24 ... ..	863	867	861	881	868
25 ... ..	860	868	863	882	866
26 ... ..	859	870	864	881	869
27 .. ...	860	865	861	882	867
28 ... ..	857	866	862	883	867
29 ... ..	859	869	862	884	869
30 ... ..	860	869	868	887	871
Means ...	888	885	889	901	891

## VAPOUR PRESSURE.

JULY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	·858	·871	·868	·888	·871
2 ... ..	·860	·873	·871	·885	·872
3 ... ..	·861	·876	·872	·888	·874
4 ... ..	·860	·879	·875	·885	·875
5 ... ..	·861	·877	·872	·887	·874
6 ... ..	·859	·880	·875	·889	·876
7 ... ..	·861	·877	·876	·886	·875
8 ... ..	·862	·880	·878	·886	·877
9 ... ..	·859	·876	·878	·881	·874
10 ... ..	·860	·878	·874	·881	·873
11 ... ..	·861	·875	·874	·881	·873
12 ... ..	·857	·876	·871	·877	·870
13 ... ..	·858	·874	·871	·874	·869
14 ... ..	·854	·876	·873	·874	·869
15 ... ..	·855	·872	·868	·874	·867
16 ... ..	·855	·874	·869	·868	·867
17 ... ..	·855	·875	·865	·868	·866
18 ... ..	·851	·875	·865	·868	·865
19 ... ..	·849	·875	·865	·866	·866
20 ... ..	·852	·875	·863	·866	·864
21 ... ..	·851	·874	·862	·865	·863
22 ... ..	·850	·874	·865	·864	·863
23 ... ..	·849	·872	·864	·862	·862
24 ... ..	·848	·872	·864	·862	·862
25 ... ..	·848	·872	·864	·861	·861
26 ... ..	·851	·872	·868	·866	·864
27 ... ..	·851	·876	·867	·866	·865
28 ... ..	·849	·876	·872	·869	·867
29 ... ..	·854	·876	·876	·867	·868
30 ... ..	·857	·880	·875	·871	·871
31 ... ..	·857	·879	·879	·871	·872
Means ...	·855	·875	·870	·874	·869



## WET BULB.

OCTOBER.

DATE.			4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Wet Minimum.
1	...	...	75.9	78.9	78.6	76.9	77.6	72.0
2	...	...	75.7	78.9	78.5	76.9	77.5	71.9
3	...	...	75.6	78.8	78.5	76.8	77.4	71.7
4	...	...	75.5	78.7	78.4	76.7	77.3	71.6
5	...	...	75.4	78.7	78.3	76.6	77.3	71.4
6	...	...	75.2	78.6	78.2	76.5	77.1	71.3
7	...	...	75.0	78.5	78.1	76.4	77.0	71.1
8	...	...	74.9	78.4	78.0	76.4	76.9	70.9
9	...	...	74.8	78.3	77.9	76.3	76.8	70.7
10	...	...	74.6	78.1	77.8	76.1	76.7	70.6
11	...	...	74.5	78.0	77.7	76.0	76.6	70.4
12	...	...	74.3	77.8	77.6	75.9	76.4	70.2
13	...	...	74.2	77.6	77.4	75.7	76.2	70.1
14	...	...	74.0	77.5	77.3	75.6	76.1	69.9
15	...	...	73.8	77.3	77.1	75.4	75.9	69.7
16	...	...	73.6	77.2	77.0	75.2	75.8	69.5
17	...	...	73.4	77.0	76.9	75.1	75.6	69.3
18	...	...	73.2	76.9	76.8	74.9	75.5	69.2
19	...	...	73.0	76.8	76.7	74.8	75.3	69.0
20	...	...	72.9	76.7	76.6	74.6	75.2	68.9
21	...	...	72.7	76.5	76.5	74.5	75.1	68.7
22	...	...	72.5	76.3	76.3	74.3	74.9	68.5
23	...	...	72.3	76.1	76.1	74.1	74.7	68.3
24	...	...	72.1	76.0	76.0	73.8	74.5	68.1
25	...	...	71.8	75.8	75.8	73.6	74.3	67.9
26	...	...	71.6	75.6	75.7	73.5	74.1	67.7
27	...	...	71.4	75.4	75.6	73.3	73.9	67.6
28	...	...	71.2	75.3	75.5	73.2	73.8	67.4
29	...	...	71.0	75.1	75.4	73.0	73.6	67.2
30	...	...	70.9	74.9	75.2	72.9	73.5	67.1
31	...	...	70.8	74.8	75.1	72.8	73.4	67.0
Means	...	...	73.5	77.1	77.0	75.1	75.7	69.5

## WET BULB.

NOVEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Wet Minimum.
1 ... ..	70.7	74.6	75.0	72.8	73.3	66.8
2 ... ..	70.6	74.5	74.8	72.6	73.1	66.7
3 ... ..	70.5	74.3	74.7	72.5	73.0	66.6
4 ... ..	70.4	74.1	74.5	72.4	72.9	66.4
5 ... ..	70.2	73.9	74.3	72.2	72.7	66.2
6 ... ..	70.0	73.6	74.1	72.0	72.4	66.0
7 ... ..	69.8	73.3	73.8	71.8	72.2	65.8
8 ... ..	69.6	73.0	73.6	71.6	72.0	65.6
9 ... ..	69.5	72.7	73.3	71.4	71.7	65.3
10 ... ..	69.3	72.4	73.1	71.2	71.5	65.1
11 ... ..	69.1	72.1	72.8	70.9	71.2	64.9
12 ... ..	68.8	71.8	72.6	70.7	71.0	64.7
13 ... ..	68.6	71.6	72.4	70.5	70.8	64.5
14 ... ..	68.4	71.4	72.2	70.3	70.6	64.3
15 ... ..	68.2	71.1	71.9	70.0	70.3	64.1
16 ... ..	67.9	70.8	71.7	69.8	70.1	63.9
17 ... ..	67.7	70.6	71.4	69.6	69.8	63.7
18 ... ..	67.5	70.5	71.3	69.4	69.7	63.6
19 ... ..	67.4	70.3	71.1	69.3	69.5	63.4
20 ... ..	67.2	70.2	71.0	69.1	69.4	63.3
21 ... ..	67.1	70.1	70.8	69.0	69.3	63.2
22 ... ..	66.9	70.1	70.7	68.8	69.1	63.1
23 ... ..	66.7	70.0	70.6	68.6	69.0	62.9
24 ... ..	66.5	69.9	70.5	68.5	68.9	62.8
25 ... ..	66.3	69.8	70.4	68.3	68.7	62.6
26 ... ..	66.2	69.8	70.3	68.2	68.6	62.4
27 ... ..	66.0	69.7	70.2	68.0	68.5	62.2
28 ... ..	65.8	69.6	70.1	67.9	68.4	62.0
29 ... ..	65.5	69.5	69.9	67.7	68.2	61.7
30 ... ..	65.3	69.4	69.8	67.5	68.0	61.5
Means ...	68.1	71.5	72.1	70.1	70.5	64.2

## WET BULB.

DECEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.	Wet Minimum.
1 ... ..	65.1	69.3	69.7	67.3	67.9	61.2
2 ... ..	64.8	69.2	69.5	67.1	67.7	60.9
3 ... ..	64.5	69.0	69.4	66.9	67.5	60.6
4 ... ..	64.2	68.9	69.2	66.7	67.3	60.3
5 ... ..	63.9	68.8	69.2	66.6	67.1	60.0
6 ... ..	63.7	68.7	69.1	66.5	67.0	59.8
7 ... ..	63.6	68.7	69.1	66.4	67.0	59.6
8 ... ..	63.4	68.6	69.0	66.4	66.9	59.4
9 ... ..	63.3	68.6	68.9	66.3	66.8	59.3
10 ... ..	63.2	68.5	68.9	66.3	66.7	59.2
11 ... ..	63.1	68.3	68.8	66.2	66.6	59.0
12 ... ..	62.9	68.2	68.6	66.1	66.5	58.9
13 ... ..	62.8	68.0	68.5	66.0	66.3	58.8
14 ... ..	62.7	67.9	68.4	65.9	66.2	58.7
15 ... ..	62.6	67.8	68.3	65.8	66.1	58.6
16 ... ..	62.5	67.7	68.2	65.7	66.0	58.5
17 ... ..	62.4	67.6	68.1	65.7	66.0	58.4
18 ... ..	62.4	67.5	68.0	65.6	65.9	58.3
19 ... ..	62.3	67.4	67.9	65.5	65.8	58.2
20 ... ..	62.2	67.3	67.8	65.4	65.7	58.1
21 ... ..	62.1	67.2	67.7	65.3	65.6	58.0
22 ... ..	62.0	67.2	67.7	65.2	65.5	57.9
23 ... ..	61.9	67.1	67.6	65.1	65.4	57.8
24 ... ..	61.8	67.1	67.6	65.1	65.4	57.7
25 ... ..	61.8	67.1	67.5	65.0	65.4	57.6
26 ... ..	61.7	67.1	67.5	65.0	65.3	57.5
27 ... ..	61.6	67.2	67.6	65.0	65.4	57.5
28 ... ..	61.6	67.2	67.7	65.0	65.4	57.4
29 ... ..	61.7	67.4	67.8	65.1	65.5	57.5
30 ... ..	61.8	67.5	67.9	65.2	65.6	57.5
31 ... ..	61.8	67.6	68.0	65.2	65.7	57.5
Means ...	62.8	67.9	68.4	65.8	66.2	58.7

## VAPOUR PRESSURE.

JANUARY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	·520	·558	·566	·568	·551
2 ... ..	·522	·561	·569	·568	·553
3 ... ..	·523	·564	·562	·571	·555
4 ... ..	·521	·567	·566	·572	·557
5 ... ..	·523	·566	·565	·574	·557
6 ... ..	·524	·565	·567	·571	·557
7 ... ..	·522	·568	·567	·571	·557
8 ... ..	·523	·567	·568	·572	·558
9 ... ..	·524	·569	·573	·578	·560
10 ... ..	·524	·572	·572	·576	·562
11 ... ..	·525	·574	·573	·576	·563
12 ... ..	·529	·576	·574	·580	·565
13 ... ..	·529	·575	·573	·580	·564
14 ... ..	·529	·578	·576	·582	·566
15 ... ..	·529	·581	·579	·581	·568
16 ... ..	·532	·579	·581	·584	·569
17 ... ..	·537	·585	·584	·588	·574
18 ... ..	·538	·588	·586	·590	·576
19 ... ..	·542	·590	·588	·594	·579
20 ... ..	·547	·589	·591	·596	·581
21 ... ..	·551	·592	·590	·599	·583
22 ... ..	·555	·594	·592	·604	·586
23 ... ..	·559	·598	·594	·606	·590
24 ... ..	·563	·600	·597	·609	·592
25 ... ..	·564	·603	·595	·610	·593
26 ... ..	·569	·605	·598	·612	·596
27 ... ..	·569	·604	·601	·613	·597
28 ... ..	·573	·603	·604	·616	·599
29 ... ..	·574	·605	·606	·620	·601
30 ... ..	·578	·608	·609	·622	·605
31 ... ..	·579	·606	·611	·624	·606
Means ...	·542	·584	·582	·592	·575

## VAPOUR PRESSURE.

FEBRUARY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	·583	·608	·614	·626	·608
2 ... ..	·584	·611	·616	·628	·610
3 ... ..	·584	·612	·619	·633	·612
4 ... ..	·589	·618	·625	·638	·618
5 ... ..	·593	·621	·632	·642	·622
6 ... ..	·595	·626	·637	·647	·626
7 ... ..	·597	·622	·640	·649	·627
8 ... ..	·601	·633	·643	·652	·632
9 ... ..	·605	·640	·649	·657	·638
10 ... ..	·608	·641	·654	·662	·641
11 ... ..	·613	·648	·657	·667	·646
12 ... ..	·614	·649	·654	·669	·647
13 ... ..	·616	·652	·657	·670	·649
14 ... ..	·621	·654	·656	·672	·651
15 ... ..	·622	·655	·653	·674	·651
16 ... ..	·624	·658	·654	·674	·653
17 ... ..	·629	·660	·656	·675	·655
18 ... ..	·631	·657	·654	·681	·656
19 ... ..	·636	·659	·656	·683	·659
20 ... ..	·638	·660	·654	·685	·659
21 ... ..	·639	·657	·656	·686	·660
22 ... ..	·643	·658	·657	·687	·661
23 ... ..	·644	·659	·658	·688	·662
24 ... ..	·650	·657	·661	·694	·666
25 ... ..	·651	·658	·662	·696	·667
26 ... ..	·652	·656	·669	·698	·669
27 ... ..	·658	·657	·672	·699	·672
28 ... ..	·659	·664	·679	·705	·677
Means ...	·621	·645	·650	·669	·646

## VAPOUR PRESSURE.

MARCH.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	·667	·664	·685	·708	·681
2 ... ..	·671	·671	·694	·714	·688
3 ... ..	·676	·678	·678	·720	·692
4 ... ..	·678	·677	·700	·722	·694
5 ... ..	·681	·684	·706	·723	·696
6 ... ..	·686	·687	·708	·730	·703
7 ... ..	·690	·689	·716	·731	·707
8 ... ..	·695	·692	·719	·738	·711
9 ... ..	·698	·695	·723	·745	·715
10 ... ..	·703	·704	·727	·746	·720
11 ... ..	·712	·711	·735	·753	·723
12 ... ..	·716	·714	·739	·759	·732
13 ... ..	·725	·721	·742	·761	·737
14 ... ..	·729	·727	·745	·767	·742
15 ... ..	·734	·729	·748	·773	·746
16 ... ..	·739	·731	·749	·775	·749
17 ... ..	·744	·734	·757	·777	·753
18 ... ..	·750	·735	·760	·784	·757
19 ... ..	·757	·741	·771	·789	·765
20 ... ..	·762	·748	·774	·796	·770
21 ... ..	·768	·747	·781	·799	·774
22 ... ..	·774	·757	·788	·807	·782
23 ... ..	·780	·764	·790	·809	·786
24 ... ..	·783	·767	·793	·812	·789
25 ... ..	·784	·769	·796	·815	·791
26 ... ..	·787	·772	·798	·818	·794
27 ... ..	·788	·771	·797	·821	·794
28 ... ..	·791	·772	·798	·824	·796
29 ... ..	·793	·771	·801	·827	·798
30 ... ..	·795	·774	·804	·830	·801
31 ... ..	·797	·781	·803	·834	·804
Means ...	·727	·748	·753	·774	·748

## VAPOUR PRESSURE.

APRIL.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	·798	·784	·808	·832	·806
2 ... ..	·801	·787	·806	·837	·808
3 ... ..	·802	·790	·809	·840	·810
4 ... ..	·809	·792	·812	·842	·814
5 ... ..	·811	·791	·815	·846	·816
6 ... ..	·814	·792	·820	·850	·819
7 ... ..	·815	·794	·823	·853	·821
8 ... ..	·823	·798	·826	·856	·826
9 ... ..	·826	·801	·829	·855	·828
10 ... ..	·827	·802	·834	·859	·831
11 ... ..	·826	·806	·834	·859	·831
12 ... ..	·830	·804	·838	·862	·834
13 ... ..	·833	·807	·843	·862	·836
14 ... ..	·836	·809	·843	·866	·840
15 ... ..	·839	·809	·851	·869	·842
16 ... ..	·842	·810	·855	·867	·844
17 ... ..	·845	·815	·859	·871	·848
18 ... ..	·844	·813	·858	·871	·847
19 ... ..	·846	·816	·862	·874	·850
20 ... ..	·845	·815	·862	·873	·849
21 ... ..	·848	·820	·867	·876	·853
22 ... ..	·847	·823	·870	·879	·855
23 ... ..	·850	·826	·874	·882	·858
24 ... ..	·853	·829	·877	·884	·861
25 ... ..	·856	·829	·881	·887	·863
26 ... ..	·857	·837	·884	·890	·867
27 ... ..	·860	·841	·889	·892	·871
28 ... ..	·863	·841	·888	·896	·872
29 ... ..	·866	·846	·892	·898	·874
30 ... ..	·868	·851	·895	·897	·878
Mean ...	·836	·813	·850	·867	·842

## VAPOUR PRESSURE.

MAY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	·871	·854	·900	·900	·881
2 ... ..	·878	·858	·899	·903	·885
3 ... ..	·882	·863	·903	·902	·888
4 ... ..	·880	·863	·902	·906	·889
5 ... ..	·883	·872	·904	·909	·892
6 ... ..	·887	·872	·903	·909	·893
7 ... ..	·891	·877	·908	·914	·898
8 ... ..	·889	·877	·906	·914	·897
9 ... ..	·894	·882	·906	·917	·900
10 ... ..	·883	·882	·904	·917	·897
11 ... ..	·896	·886	·908	·920	·903
12 ... ..	·900	·885	·906	·920	·903
13 ... ..	·903	·888	·908	·924	·906
14 ... ..	·906	·893	·911	·927	·909
15 ... ..	·905	·898	·915	·926	·911
16 ... ..	·908	·911	·918	·930	·917
17 ... ..	·911	·911	·918	·930	·918
18 ... ..	·916	·906	·923	·935	·920
19 ... ..	·924	·911	·916	·934	·921
20 ... ..	·922	·912	·925	·938	·924
21 ... ..	·927	·917	·929	·937	·928
22 ... ..	·930	·921	·933	·940	·931
23 ... ..	·929	·921	·936	·939	·931
24 ... ..	·932	·925	·938	·939	·934
25 ... ..	·931	·927	·939	·937	·934
26 ... ..	·936	·922	·939	·942	·935
27 ... ..	·936	·923	·945	·942	·937
28 ... ..	·936	·923	·945	·942	·937
29 ... ..	·934	·923	·945	·941	·936
30 ... ..	·934	·923	·937	·941	·934
31 ... ..	·934	·920	·938	·936	·932
Means ...	·909	·898	·920	·926	·913



## VAPOUR PRESSURE.

JUNE.

DATE.	4 Hrs.	10 Hrs.	15 Hrs.	22 Hrs.	MEAN.
1 ... ..	834	820	835	836	831
2 ... ..	839	817	833	831	827
3 ... ..	825	813	828	833	825
4 ... ..	825	810	823	828	822
5 ... ..	822	808	820	823	818
6 ... ..	818	804	815	825	816
7 ... ..	814	801	817	821	813
8 ... ..	811	802	812	818	811
9 ... ..	808	800	809	813	807
10 ... ..	804	806	804	810	804
11 ... ..	800	804	801	812	802
12 ... ..	807	800	807	808	806
13 ... ..	805	808	804	801	805
14 ... ..	807	805	809	807	809
15 ... ..	804	801	805	804	806
16 ... ..	801	877	805	801	804
17 ... ..	878	874	881	892	881
18 ... ..	875	871	876	889	878
19 ... ..	873	867	871	886	874
20 ... ..	870	869	868	883	873
21 ... ..	868	865	865	884	871
22 ... ..	865	867	861	881	869
23 ... ..	862	870	864	883	870
24 ... ..	863	867	861	881	868
25 ... ..	860	868	863	882	868
26 ... ..	859	870	864	881	869
27 .. ...	860	865	861	882	867
28 ... ..	857	866	862	883	867
29 ... ..	859	869	862	884	869
30 ... ..	860	869	868	887	871
Means ...	868	865	869	891	891

## VAPOUR PRESSURE.

JULY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	·858	·871	·868	·888	·871
2 ... ..	·860	·873	·871	·885	·872
3 ... ..	·861	·876	·872	·888	·874
4 ... ..	·860	·879	·875	·885	·875
5 ... ..	·861	·877	·872	·887	·874
6 ... ..	·859	·880	·875	·889	·876
7 ... ..	·861	·877	·876	·886	·875
8 ... ..	·862	·880	·878	·886	·877
9 ... ..	·859	·876	·878	·881	·874
10 ... ..	·860	·878	·874	·881	·873
11 ... ..	·861	·875	·874	·881	·873
12 ... ..	·857	·876	·871	·877	·870
13 ... ..	·858	·874	·871	·874	·869
14 ... ..	·854	·876	·873	·874	·869
15 ... ..	·855	·872	·868	·874	·867
16 ... ..	·855	·874	·869	·868	·867
17 ... ..	·855	·875	·865	·868	·866
18 ... ..	·851	·875	·865	·868	·865
19 ... ..	·849	·875	·865	·866	·866
20 ... ..	·852	·875	·863	·866	·864
21 ... ..	·851	·874	·862	·865	·863
22 ... ..	·850	·874	·865	·864	·863
23 ... ..	·849	·872	·864	·862	·862
24 ... ..	·848	·872	·864	·862	·862
25 ... ..	·848	·872	·864	·861	·861
26 ... ..	·851	·872	·868	·866	·864
27 ... ..	·851	·876	·867	·866	·865
28 ... ..	·849	·876	·872	·869	·867
29 ... ..	·854	·876	·876	·867	·868
30 ... ..	·857	·880	·875	·871	·871
31 ... ..	·857	·879	·879	·871	·872
Means ...	·855	·875	·870	·874	·869

## VAPOUR PRESSURE.

AUGUST.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	·860	·879	·878	·874	·878
2 ... ..	·863	·883	·883	·878	·877
3 ... ..	·863	·882	·883	·878	·877
4 ... ..	·863	·882	·889	·878	·878
5 ... ..	·867	·882	·889	·878	·879
6 ... ..	·867	·886	·889	·882	·881
7 ... ..	·867	·886	·892	·882	·882
8 ... ..	·869	·886	·890	·884	·882
9 ... ..	·869	·886	·890	·884	·882
10 ... ..	·869	·886	·890	·888	·883
11 ... ..	·869	·891	·890	·888	·885
12 ... ..	·869	·890	·885	·885	·882
13 ... ..	·870	·890	·887	·885	·883
14 ... ..	·866	·890	·887	·886	·882
15 ... ..	·866	·888	·887	·886	·882
16 ... ..	·867	·887	·888	·888	·883
17 ... ..	·868	·886	·888	·888	·883
18 ... ..	·864	·884	·888	·888	·881
19 ... ..	·865	·887	·888	·889	·882
20 ... ..	·869	·887	·888	·889	·883
21 ... ..	·870	·887	·885	·891	·883
22 ... ..	·871	·886	·886	·891	·884
23 ... ..	·873	·891	·886	·892	·886
24 ... ..	·873	·892	·888	·893	·887
25 ... ..	·874	·892	·889	·893	·887
26 ... ..	·876	·889	·892	·895	·888
27 ... ..	·877	·889	·889	·896	·888
28 ... ..	·877	·890	·890	·896	·888
29 ... ..	·878	·892	·890	·898	·890
30 ... ..	·880	·892	·887	·899	·890
31 ... ..	·880	·893	·888	·899	·890
Means ...	·870	·887	·888	·888	·883

## VAPOUR PRESSURE.

SEPTEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	·881	·891	·890	·900	·891
2 ... ..	·881	·892	·885	·900	·890
3 ... ..	·881	·892	·885	·900	·890
4 ... ..	·881	·889	·885	·900	·889
5 ... ..	·886	·893	·888	·905	·893
6 ... ..	·886	·893	·887	·905	·893
7 ... ..	·884	·893	·886	·905	·892
8 ... ..	·889	·893	·884	·903	·892
9 ... ..	·889	·893	·887	·903	·893
10 ... ..	·889	·893	·891	·908	·895
11 ... ..	·887	·896	·889	·908	·895
12 ... ..	·892	·896	·888	·908	·896
13 ... ..	·892	·895	·892	·908	·897
14 ... ..	·892	·900	·891	·908	·898
15 ... ..	·892	·900	·891	·912	·899
16 ... ..	·893	·898	·891	·912	·899
17 ... ..	·893	·898	·891	·908	·898
18 ... ..	·893	·898	·891	·909	·898
19 ... ..	·894	·898	·892	·905	·897
20 ... ..	·890	·897	·888	·906	·895
21 ... ..	·891	·897	·889	·903	·895
22 ... ..	·888	·897	·891	·900	·894
23 ... ..	·890	·896	·891	·900	·894
24 ... ..	·885	·895	·887	·901	·892
25 ... ..	·887	·895	·887	·897	·892
26 ... ..	·884	·893	·884	·893	·891
27 ... ..	·881	·897	·884	·894	·889
28 ... ..	·881	·895	·884	·891	·888
29 ... ..	·878	·895	·883	·891	·887
30 ... ..	·875	·889	·878	·883	·883
Means ...	·887	·895	·888	·903	·893

## VAPOUR PRESSURE.

OCTOBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	878	869	860	864	881
2 ... ..	865	868	875	865	878
3 ... ..	862	865	875	862	876
4 ... ..	859	860	872	879	873
5 ... ..	856	860	869	875	870
6 ... ..	850	877	865	872	866
7 ... ..	848	874	862	868	863
8 ... ..	840	870	866	869	869
9 ... ..	838	867	865	866	857
10 ... ..	832	859	851	860	851
11 ... ..	839	856	848	857	848
12 ... ..	834	849	845	855	843
13 ... ..	824	841	838	843	838
14 ... ..	816	838	835	846	834
15 ... ..	813	830	827	841	828
16 ... ..	807	827	824	833	823
17 ... ..	803	830	821	832	819
18 ... ..	797	815	818	826	814
19 ... ..	792	812	815	823	811
20 ... ..	790	806	810	818	807
21 ... ..	785	799	807	815	803
22 ... ..	780	792	800	809	795
23 ... ..	774	784	792	804	789
24 ... ..	770	781	790	794	784
25 ... ..	761	778	782	787	777
26 ... ..	761	768	781	786	774
27 ... ..	749	761	779	779	767
28 ... ..	744	760	777	772	764
29 ... ..	737	752	775	770	759
30 ... ..	726	747	768	766	754
31 ... ..	734	746	766	768	752
Means ...	805	824	825	831	821

## VAPOUR PRESSURE.

NOVEMBER.

Date.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	731	739	763	765	750
2 ... ..	727	737	758	758	745
3 ... ..	725	730	754	755	741
4 ... ..	722	724	749	753	737
5 ... ..	716	718	742	746	731
6 ... ..	711	709	735	739	724
7 ... ..	704	699	724	732	715
8 ... ..	698	689	717	726	708
9 ... ..	696	678	706	719	700
10 ... ..	688	669	700	713	693
11 ... ..	683	660	689	704	684
12 ... ..	672	650	684	697	676
13 ... ..	666	645	677	691	670
14 ... ..	658	639	672	689	665
15 ... ..	652	630	662	674	655
16 ... ..	642	621	657	669	647
17 ... ..	636	616	643	663	641
18 ... ..	630	614	645	657	637
19 ... ..	628	609	640	654	633
20 ... ..	622	606	639	643	629
21 ... ..	620	605	634	647	627
22 ... ..	615	608	633	642	625
23 ... ..	611	606	632	638	621
24 ... ..	606	605	629	635	619
25 ... ..	603	602	627	630	616
26 ... ..	602	602	624	623	614
27 ... ..	599	600	622	623	611
28 ... ..	594	607	619	624	609
29 ... ..	588	595	613	619	604
30 ... ..	585	591	610	615	600
Means ...	654	646	673	663	664

## VAPOUR PRESSURE.

DECEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	·582	·589	·608	·611	·596
2 ... ..	·577	·586	·600	·607	·593
3 ... ..	·571	·580	·596	·604	·588
4 ... ..	·565	·578	·592	·599	·584
5 ... ..	·558	·575	·592	·597	·581
6 ... ..	·554	·572	·588	·594	·577
7 ... ..	·553	·573	·588	·592	·577
8 ... ..	·548	·569	·585	·592	·574
9 ... ..	·547	·571	·581	·590	·572
10 ... ..	·543	·567	·581	·591	·571
11 ... ..	·542	·561	·579	·587	·567
12 ... ..	·536	·558	·572	·585	·563
13 ... ..	·534	·552	·570	·581	·559
14 ... ..	·534	·551	·567	·580	·558
15 ... ..	·530	·549	·563	·578	·555
16 ... ..	·528	·547	·561	·574	·553
17 ... ..	·525	·544	·559	·574	·551
18 ... ..	·525	·542	·555	·570	·548
19 ... ..	·522	·540	·553	·568	·546
20 ... ..	·519	·537	·550	·565	·543
21 ... ..	·517	·535	·547	·563	·541
22 ... ..	·513	·536	·548	·560	·539
23 ... ..	·512	·534	·544	·558	·537
24 ... ..	·510	·535	·546	·560	·538
25 ... ..	·512	·537	·542	·558	·537
26 ... ..	·510	·537	·542	·559	·537
27 ... ..	·508	·542	·546	·560	·539
28 ... ..	·509	·542	·549	·560	·540
29 ... ..	·513	·549	·552	·564	·545
30 ... ..	·512	·552	·554	·567	·546
31 ... ..	·517	·555	·558	·568	·550
Means ...	·533	·555	·567	·578	·558

## RELATIVE HUMIDITY.

JANUARY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	86	61	59	79	71
2 ... ..	87	61	59	79	72
3 ... ..	87	61	59	80	72
4 ... ..	87	61	59	81	72
5 ... ..	88	61	59	81	72
6 ... ..	88	61	59	81	72
7 ... ..	88	61	59	81	72
8 ... ..	89	61	59	82	73
9 ... ..	90	61	60	82	73
10 ... ..	90	61	59	83	73
11 ... ..	90	61	59	83	73
12 ... ..	91	61	59	83	74
13 ... ..	91	61	59	83	74
14 ... ..	91	61	59	83	74
15 ... ..	91	61	59	82	73
16 ... ..	91	61	59	83	74
17 ... ..	92	61	59	83	74
18 ... ..	91	61	59	82	73
19 ... ..	92	61	59	82	74
20 ... ..	92	61	59	82	74
21 ... ..	92	61	58	82	73
22 ... ..	92	61	58	82	73
23 ... ..	92	61	58	82	73
24 ... ..	92	61	58	82	73
25 ... ..	91	61	58	82	73
26 ... ..	91	61	58	82	73
27 ... ..	91	61	58	81	73
28 ... ..	91	60	58	81	73
29 ... ..	90	60	58	81	72
30 ... ..	90	60	58	81	72
31 ... ..	90	60	58	81	72
Means ...	90	61	58	82	73



## RELATIVE HUMIDITY.

FEBRUARY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	90	60	58	81	72
2 ... ..	89	60	58	81	72
3 ... ..	89	60	58	81	72
4 ... ..	89	61	59	81	73
5 ... ..	89	61	60	81	73
6 ... ..	89	61	60	81	73
7 ... ..	88	61	60	81	73
8 ... ..	88	60	60	80	72
9 ... ..	89	61	60	81	73
10 ... ..	88	60	61	81	73
11 ... ..	88	61	61	81	73
12 ... ..	87	60	60	80	72
13 ... ..	87	60	60	80	72
14 ... ..	87	60	60	80	72
15 ... ..	87	61	60	79	72
16 ... ..	87	61	59	79	72
17 ... ..	87	61	59	79	72
18 ... ..	87	60	58	79	71
19 ... ..	86	60	58	79	71
20 ... ..	87	60	58	78	71
21 ... ..	87	59	58	78	71
22 ... ..	87	59	58	77	70
23 ... ..	87	59	58	77	70
24 ... ..	87	58	58	77	70
25 ... ..	86	58	57	77	70
26 ... ..	86	58	57	77	70
27 ... ..	86	57	57	77	69
28 ... ..	86	58	58	77	70
Means ...	88	60	59	79	72

## RELATIVE HUMIDITY.

MARCH.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ...	86	57	58	76	69
2 ...	86	57	59	76	70
3 ...	86	57	59	77	70
4 ...	85	57	59	76	69
5 ...	85	58	59	76	70
6 ...	85	58	60	77	70
7 ...	85	58	60	76	70
8 ...	85	58	60	77	70
9 ...	84	58	61	78	70
10 ...	84	59	60	77	70
11 ...	85	59	61	78	71
12 ...	85	59	62	78	71
13 ...	85	60	62	78	71
14 ...	85	60	62	78	71
15 ...	85	59	62	78	71
16 ...	85	59	62	78	71
17 ...	85	59	62	77	71
18 ...	85	59	62	78	71
19 ...	85	59	63	78	71
20 ...	85	60	63	78	72
21 ...	85	60	63	78	72
22 ...	86	60	64	78	72
23 ...	86	60	64	78	72
24 ...	86	60	64	78	72
25 ...	85	60	64	78	72
26 ...	85	60	63	78	72
27 ...	85	60	63	78	72
28 ...	85	59	63	78	71
29 ...	84	59	63	78	71
30 ...	84	59	63	78	71
31 ...	84	59	63	79	71
Means ...	85	59	61	78	71

## RELATIVE HUMIDITY.

APRIL.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	84	60	63	78	71
2 ... ..	84	60	63	79	72
3 ... ..	83	60	63	79	71
4 ... ..	84	60	63	79	72
5 ... ..	83	59	63	79	71
6 ... ..	83	59	63	80	71
7 ... ..	83	59	63	80	71
8 ... ..	83	59	64	80	72
9 ... ..	83	59	63	79	71
10 ... ..	83	58	64	80	71
11 ... ..	83	58	64	80	71
12 ... ..	83	58	64	80	71
13 ... ..	83	58	64	80	71
14 ... ..	83	58	65	80	72
15 ... ..	83	58	65	80	72
16 ... ..	84	58	65	80	72
17 ... ..	84	58	65	80	72
18 ... ..	83	58	65	80	72
19 ... ..	83	58	65	80	72
20 ... ..	82	57	65	79	71
21 ... ..	82	58	66	79	71
22 ... ..	82	58	66	79	71
23 ... ..	82	58	66	79	71
24 ... ..	82	58	66	79	71
25 ... ..	82	58	66	79	71
26 ... ..	82	58	66	79	71
27 ... ..	82	58	67	79	72
28 ... ..	82	58	66	79	71
29 ... ..	82	59	67	78	72
30 ... ..	82	59	67	78	72
Means ...	83	58	65	79	71

## RELATIVE HUMIDITY.

MAY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	82	59	67	78	72
2 ... ..	82	60	67	78	72
3 ... ..	82	60	67	78	72
4 ... ..	82	61	67	78	72
5 ... ..	82	61	66	78	72
6 ... ..	82	61	66	78	72
7 ... ..	82	62	66	79	72
8 ... ..	82	62	66	79	72
9 ... ..	82	62	66	79	72
10 ... ..	82	62	66	79	72
11 ... ..	82	62	66	79	72
12 ... ..	82	62	65	79	72
13 ... ..	82	62	65	79	72
14 ... ..	82	62	65	79	72
15 ... ..	82	62	65	78	72
16 ... ..	82	62	65	79	72
17 ... ..	82	62	65	79	72
18 ... ..	82	62	65	79	72
19 ... ..	82	63	65	79	73
20 ... ..	82	63	65	79	72
21 ... ..	82	63	65	79	73
22 ... ..	82	63	65	79	73
23 ... ..	82	63	65	78	72
24 ... ..	82	63	66	78	72
25 ... ..	82	64	66	78	73
26 ... ..	82	63	66	78	72
27 ... ..	82	64	66	78	73
28 ... ..	82	64	66	78	73
29 ... ..	82	64	66	78	73
30 ... ..	82	64	66	78	73
31 ... ..	82	64	66	77	72
Means ...	82	62	66	78	72

## RELATIVE HUMIDITY.

JUNE.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	82	64	66	77	73
2 ... ..	81	64	66	77	72
3 ... ..	81	64	66	77	72
4 ... ..	81	64	66	77	72
5 ... ..	81	64	66	77	72
6 ... ..	81	64	66	77	72
7 ... ..	81	64	66	77	72
8 ... ..	81	65	66	77	72
9 ... ..	81	65	66	77	72
10 ... ..	81	65	66	77	72
11 ... ..	80	65	66	77	72
12 ... ..	80	65	65	77	72
13 ... ..	81	64	65	77	72
14 ... ..	80	64	65	77	72
15 ... ..	80	64	64	77	71
16 ... ..	80	64	64	77	71
17 ... ..	80	64	65	77	72
18 ... ..	80	64	64	77	71
19 ... ..	81	64	64	77	72
20 ... ..	81	64	64	77	72
21 ... ..	81	64	64	77	72
22 ... ..	81	65	64	77	72
23 ... ..	81	66	64	78	72
24 ... ..	81	66	64	78	72
25 ... ..	81	66	65	79	73
26 ... ..	81	66	65	79	73
27 ... ..	82	65	65	79	72
28 ... ..	82	66	66	80	74
29 ... ..	82	67	66	80	74
30 ... ..	83	67	66	81	74
Means ...	81	65	65	78	72

## RELATIVE HUMIDITY.

JULY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	83	67	65	81	74
2 ... ..	83	68	66	81	75
3 ... ..	84	69	67	82	76
4 ... ..	84	68	68	82	76
5 ... ..	85	69	68	83	76
6 ... ..	85	70	68	83	77
7 ... ..	86	70	69	83	77
8 ... ..	86	70	69	83	77
9 ... ..	86	70	69	83	77
10 ... ..	87	71	69	83	78
11 ... ..	87	71	69	83	78
12 ... ..	87	71	69	83	78
13 ... ..	87	72	69	83	78
14 ... ..	87	72	68	83	78
15 ... ..	87	72	69	83	78
16 ... ..	87	72	68	82	77
17 ... ..	87	72	68	82	78
18 ... ..	86	73	68	82	77
19 ... ..	86	73	68	82	77
20 ... ..	86	73	68	82	77
21 ... ..	86	72	68	81	77
22 ... ..	85	72	68	81	77
23 ... ..	85	72	68	80	76
24 ... ..	85	72	68	80	76
25 ... ..	85	72	68	80	76
26 ... ..	84	72	68	80	76
27 ... ..	84	72	68	80	76
28 ... ..	84	72	68	80	76
29 ... ..	84	72	69	80	76
30 ... ..	84	72	68	80	76
31 ... ..	84	72	69	80	76
Means ...	85	71	68	82	77

## RELATIVE HUMIDITY.

August.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	84	72	69	80	76
2 ... ..	84	72	69	80	76
3 ... ..	84	72	69	80	76
4 ... ..	84	72	69	80	76
5 ... ..	85	72	69	80	77
6 ... ..	85	72	69	81	77
7 ... ..	85	72	69	81	77
8 ... ..	85	72	69	81	77
9 ... ..	85	72	69	81	77
10 ... ..	85	72	69	81	77
11 ... ..	85	72	69	81	77
12 ... ..	85	72	69	81	77
13 ... ..	86	72	69	81	77
14 ... ..	85	72	69	82	77
15 ... ..	85	72	69	82	77
16 ... ..	86	72	70	82	78
17 ... ..	86	71	70	82	77
18 ... ..	86	71	70	82	77
19 ... ..	86	71	70	83	78
20 ... ..	87	71	70	83	78
21 ... ..	87	71	69	83	78
22 ... ..	87	70	70	83	78
23 ... ..	88	71	70	83	78
24 ... ..	88	71	70	84	78
25 ... ..	88	71	70	84	78
26 ... ..	89	71	71	84	79
27 ... ..	89	71	71	85	79
28 ... ..	89	72	72	85	80
29 ... ..	89	72	72	85	80
30 ... ..	90	72	72	85	80
31 ... ..	90	73	72	85	80
Mean ...	86	72	70	82	78

## RELATIVE HUMIDITY.

SEPTEMBER.

Date.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	90	73	72	86	80
2 ... ..	90	73	72	86	80
3 ... ..	90	73	72	86	80
4 ... ..	90	73	72	86	80
5 ... ..	91	74	72	86	81
6 ... ..	91	74	72	86	81
7 ... ..	90	74	71	86	80
8 ... ..	91	74	71	86	81
9 ... ..	91	74	71	86	81
10 ... ..	91	74	71	86	81
11 ... ..	90	74	70	86	80
12 ... ..	91	74	70	86	80
13 ... ..	91	73	70	86	80
14 ... ..	91	74	70	86	80
15 ... ..	91	74	70	87	81
16 ... ..	91	73	70	87	80
17 ... ..	91	73	70	86	80
18 ... ..	91	73	70	87	80
19 ... ..	91	73	70	86	80
20 ... ..	91	73	70	87	80
21 ... ..	91	73	70	87	80
22 ... ..	91	73	71	87	81
23 ... ..	92	72	71	87	81
24 ... ..	91	72	71	87	80
25 ... ..	92	72	71	87	81
26 ... ..	92	72	71	87	81
27 ... ..	92	72	71	87	81
28 ... ..	92	71	71	87	80
29 ... ..	92	71	70	87	80
30 ... ..	92	70	70	87	80
Means ...	91	73	71	86	80



## RELATIVE HUMIDITY.

OCTOBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	92	70	70	86	80
2 ... ..	91	70	70	87	80
3 ... ..	91	70	70	87	80
4 ... ..	91	70	70	87	80
5 ... ..	91	70	70	87	80
6 ... ..	91	70	70	87	80
7 ... ..	91	70	70	86	79
8 ... ..	91	70	70	87	80
9 ... ..	91	70	70	87	80
10 ... ..	91	69	70	87	79
11 ... ..	91	69	70	87	79
12 ... ..	91	69	70	87	79
13 ... ..	92	68	69	86	79
14 ... ..	92	68	69	87	79
15 ... ..	92	68	69	86	79
16 ... ..	92	68	69	86	79
17 ... ..	92	68	69	86	79
18 ... ..	92	67	69	86	79
19 ... ..	92	67	68	86	78
20 ... ..	93	67	69	86	79
21 ... ..	93	66	69	93	79
22 ... ..	93	66	68	86	78
23 ... ..	93	65	68	86	78
24 ... ..	93	65	68	86	78
25 ... ..	93	66	67	85	78
26 ... ..	93	65	67	86	78
27 ... ..	92	65	68	85	78
28 ... ..	92	65	68	85	78
29 ... ..	92	64	67	85	77
30 ... ..	92	63	67	85	77
31 ... ..	92	64	67	85	77
Means ...	92	67	69	86	79

## RELATIVE HUMIDITY.

NOVEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	92	63	67	85	77
2 ... ..	92	64	67	85	77
3 ... ..	92	63	67	85	77
4 ... ..	92	63	67	85	77
5 ... ..	91	63	67	84	76
6 ... ..	91	63	67	84	76
7 ... ..	91	63	66	83	76
8 ... ..	90	62	65	83	75
9 ... ..	90	62	65	82	75
10 ... ..	89	61	65	82	74
11 ... ..	89	61	64	81	74
12 ... ..	88	60	63	81	73
13 ... ..	87	60	63	80	73
14 ... ..	86	60	63	80	72
15 ... ..	86	59	62	79	72
16 ... ..	85	59	62	79	71
17 ... ..	84	59	62	78	71
18 ... ..	84	58	62	78	71
19 ... ..	84	58	62	78	71
20 ... ..	83	59	62	77	70
21 ... ..	83	59	62	78	71
22 ... ..	83	60	62	78	71
23 ... ..	83	60	62	77	71
24 ... ..	83	60	62	78	71
25 ... ..	83	60	62	77	71
26 ... ..	84	60	62	77	71
27 ... ..	84	60	62	77	71
28 ... ..	84	60	62	78	71
29 ... ..	84	60	61	78	71
30 ... ..	85	60	61	78	71
Means ...	87	61	64	80	73

## RELATIVE HUMIDITY.

DECEMBER.

DATE.			4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1	...	...	85	60	61	79	71
2	...	...	85	60	61	78	71
3	...	...	85	59	61	79	71
4	...	...	85	60	61	79	71
5	...	...	85	59	61	79	71
6	...	...	85	59	60	79	71
7	...	...	86	59	60	79	71
8	...	...	85	59	60	79	71
9	...	...	86	59	59	79	71
10	...	...	86	9	59	79	71
11	...	...	85	58	59	79	70
12	...	...	85	58	59	79	70
13	...	...	85	58	59	78	70
14	...	...	85	57	59	78	70
15	...	...	85	57	59	78	70
16	...	...	85	57	59	78	70
17	...	...	84	57	59	78	70
18	...	...	84	57	59	77	69
19	...	..	83	57	58	77	69
20	...	...	83	57	58	77	69
21	...	...	83	57	57	76	68
22	...	...	82	58	58	76	69
23	...	...	83	58	57	76	69
24	...	...	83	58	58	77	69
25	...	...	83	59	57	77	69
26	...	...	83	59	57	77	69
27	...	...	83	59	58	78	70
28	...	...	84	59	58	78	70
29	...	...	84	60	58	78	70
30	...	...	85	60	58	79	71
31	...	...	85	60	59	79	71
Means ...			84	58	59	78	70

## CLOUD.

JANUARY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	1.7	2.3	2.1	1.7	2.0
2 ... ..	1.6	2.2	2.0	1.6	1.9
3 ... ..	1.6	2.2	1.9	1.6	1.8
4 ... ..	1.5	2.2	1.9	1.5	1.8
5 ... ..	1.4	2.1	1.8	1.4	1.7
6 ... ..	1.4	2.1	1.8	1.4	1.7
7 ... ..	1.4	2.1	1.8	1.4	1.7
8 ... ..	1.4	2.1	1.8	1.5	1.7
9 ... ..	1.4	2.1	1.8	1.6	1.7
10 ... ..	1.4	2.1	1.8	1.6	1.7
11 ... ..	1.4	2.1	1.8	1.6	1.7
12 ... ..	1.4	2.2	1.7	1.6	1.7
13 ... ..	1.4	2.2	1.7	1.6	1.7
14 ... ..	1.4	2.2	1.7	1.6	1.7
15 ... ..	1.5	2.2	1.7	1.7	1.8
16 ... ..	1.5	2.2	1.7	1.7	1.8
17 ... ..	1.5	2.2	1.7	1.8	1.8
18 ... ..	1.5	2.2	1.8	1.8	1.8
19 ... ..	1.5	2.2	1.8	1.9	1.8
20 ... ..	1.6	2.2	1.7	1.9	1.9
21 ... ..	1.6	2.2	1.7	1.9	1.9
22 ... ..	1.6	2.2	1.7	1.9	1.9
23 ... ..	1.6	2.2	1.7	1.9	1.9
24 ... ..	1.6	2.2	1.6	1.8	1.8
25 ... ..	1.5	2.1	1.6	1.7	1.7
26 ... ..	1.5	2.1	1.5	1.7	1.7
27 ... ..	1.5	2.0	1.5	1.7	1.7
28 ... ..	1.5	2.0	1.5	1.6	1.7
29 ... ..	1.5	2.0	1.5	1.6	1.7
30 ... ..	1.4	2.0	1.5	1.6	1.6
31 ... ..	1.4	2.0	1.4	1.6	1.6
Means ...	1.5	2.1	1.7	1.7	1.8

## CLOUD.

FEBRUARY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	1.4	2.0	1.4	1.6	1.6
2 ... ..	1.4	2.0	1.4	1.5	1.6
3 ... ..	1.4	2.0	1.4	1.5	1.6
4 ... ..	1.5	2.0	1.4	1.5	1.6
5 ... ..	1.5	2.1	1.4	1.5	1.6
6 ... ..	1.5	2.1	1.4	1.5	1.6
7 ... ..	1.5	2.1	1.4	1.5	1.6
8 ... ..	1.5	2.2	1.4	1.5	1.7
9 ... ..	1.5	2.2	1.4	1.6	1.7
10 ... ..	1.5	2.3	1.4	1.6	1.7
11 ... ..	1.5	2.3	1.4	1.6	1.7
12 ... ..	1.5	2.3	1.5	1.6	1.7
13 ... ..	1.5	2.3	1.5	1.6	1.7
14 ... ..	1.4	2.3	1.5	1.6	1.7
15 ... ..	1.4	2.3	1.5	1.6	1.7
16 ... ..	1.4	2.3	1.5	1.6	1.7
17 ... ..	1.5	2.3	1.5	1.6	1.7
18 ... ..	1.5	2.3	1.5	1.6	1.7
19 ... ..	1.4	2.2	1.5	1.6	1.7
20 ... ..	1.4	2.2	1.5	1.6	1.7
21 ... ..	1.4	2.1	1.5	1.6	1.7
22 ... ..	1.4	2.1	1.5	1.6	1.7
23 ... ..	1.4	2.0	1.5	1.6	1.6
24 ... ..	1.4	2.0	1.5	1.6	1.6
25 ... ..	1.4	1.9	1.5	1.6	1.6
26 ... ..	1.4	1.9	1.5	1.6	1.6
27 ... ..	1.5	2.0	1.6	1.6	1.7
28 ... ..	1.5	2.0	1.7	1.7	1.7
Means ...	1.5	2.1	1.5	1.6	1.7

## CLOUD.

MARCH.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	1.6	2.0	1.7	1.7	1.8
2 ... ..	1.7	2.0	1.8	1.8	1.8
3 ... ..	1.7	2.0	1.8	1.8	1.8
4 ... ..	1.7	2.0	1.8	1.8	1.8
5 ... ..	1.8	1.9	1.9	1.8	1.9
6 ... ..	1.8	1.9	1.9	1.9	1.9
7 ... ..	1.8	1.9	2.0	1.9	1.9
8 ... ..	1.8	1.9	2.0	1.9	1.9
9 ... ..	1.8	2.0	2.1	1.9	2.0
10 ... ..	1.9	2.0	2.2	2.0	2.0
11 ... ..	2.0	2.0	2.3	2.0	2.1
12 ... ..	2.0	2.0	2.3	2.1	2.1
13 ... ..	2.1	2.0	2.4	2.1	2.2
14 ... ..	2.2	2.0	2.4	2.1	2.2
15 ... ..	2.2	2.0	2.4	2.1	2.2
16 ... ..	2.2	2.0	2.4	2.0	2.2
17 ... ..	2.1	2.0	2.4	2.1	2.2
18 ... ..	2.2	2.0	2.4	2.1	2.2
19 ... ..	2.2	2.0	2.5	2.2	2.2
20 ... ..	2.3	2.0	2.5	2.2	2.3
21 ... ..	2.4	2.1	2.5	2.3	2.3
22 ... ..	2.4	2.1	2.6	2.4	2.4
23 ... ..	2.5	2.1	2.6	2.5	2.4
24 ... ..	2.5	2.1	2.6	2.5	2.4
25 ... ..	2.5	2.1	2.6	2.5	2.4
26 ... ..	2.5	2.1	2.6	2.5	2.4
27 ... ..	2.4	2.1	2.6	2.6	2.4
28 ... ..	2.4	2.0	2.6	2.6	2.4
29 ... ..	2.5	2.0	2.6	2.7	2.5
30 ... ..	2.5	2.0	2.6	2.7	2.5
31 ... ..	2.5	2.0	2.7	2.7	2.5
Mean ...	2.1	2.0	2.3	2.3	2.3

## CLOUD.

APRIL.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	2.5	2.0	2.7	2.8	2.5
2 ... ..	2.5	2.1	2.7	2.8	2.5
3 ... ..	2.5	2.1	2.8	2.9	2.6
4 ... ..	2.6	2.1	2.8	2.9	2.6
5 ... ..	2.6	2.1	2.8	2.9	2.6
6 ... ..	2.6	2.2	2.9	2.9	2.7
7 ... ..	2.6	2.2	2.9	2.9	2.7
8 ... ..	2.6	2.2	2.9	3.0	2.7
9 ... ..	2.7	2.3	3.0	3.1	2.8
10 ... ..	2.8	2.3	3.0	3.1	2.8
11 ... ..	2.9	2.4	3.1	3.2	2.9
12 ... ..	2.9	2.4	3.2	3.2	2.9
13 ... ..	3.0	2.4	3.3	3.3	3.0
14 ... ..	3.0	2.5	3.4	3.4	3.1
15 ... ..	3.0	2.5	3.5	3.4	3.1
16 ... ..	3.0	2.5	3.5	3.5	3.1
17 ... ..	3.1	2.6	3.6	3.5	3.2
18 ... ..	3.1	2.6	3.6	3.5	3.2
19 ... ..	3.2	2.7	3.7	3.5	3.3
20 ... ..	3.2	2.7	3.7	3.6	3.3
21 ... ..	3.3	2.7	3.8	3.6	3.4
22 ... ..	3.3	2.7	3.8	3.6	3.4
23 ... ..	3.4	2.7	3.8	3.5	3.4
24 ... ..	3.4	2.7	3.8	3.5	3.4
25 ... ..	3.4	2.7	3.8	3.6	3.4
26 ... ..	3.4	2.7	3.8	3.6	3.4
27 ... ..	3.5	2.8	3.8	3.6	3.4
28 ... ..	3.6	2.8	3.8	3.7	3.5
29 ... ..	3.6	2.8	3.8	3.8	3.5
30 ... ..	3.7	2.9	3.8	3.8	3.6
Mean ...	3.0	2.5	3.4	3.3	3.1

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CLOUD.  
MAY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	3.8	3.0	3.8	3.9	3.6
2 ... ..	3.9	3.0	3.9	3.9	3.7
3 ... ..	3.9	3.1	3.9	4.0	3.7
4 ... ..	3.9	3.1	4.0	4.1	3.8
5 ... ..	4.0	3.2	4.0	4.2	3.9
6 ... ..	4.1	3.3	4.1	4.3	4.0
7 ... ..	4.1	3.4	4.2	4.4	4.0
8 ... ..	4.3	3.5	4.3	4.5	4.2
9 ... ..	4.4	3.7	4.3	4.6	4.3
10 ... ..	4.5	3.8	4.4	4.6	4.3
11 ... ..	4.6	3.9	4.4	4.7	4.4
12 ... ..	4.6	4.0	4.4	4.7	4.4
13 ... ..	4.6	4.1	4.4	4.8	4.5
14 ... ..	4.6	4.2	4.5	4.8	4.5
15 ... ..	4.7	4.2	4.5	4.8	4.6
16 ... ..	4.7	4.3	4.6	4.8	4.6
17 ... ..	4.8	4.4	4.6	4.9	4.7
18 ... ..	4.8	4.5	4.7	4.9	4.7
19 ... ..	4.9	4.6	4.7	4.9	4.8
20 ... ..	4.9	4.7	4.7	4.9	4.8
21 ... ..	4.9	4.7	4.7	4.9	4.8
22 ... ..	4.9	4.8	4.7	4.9	4.8
23 ... ..	4.9	4.8	4.7	4.9	4.8
24 ... ..	4.9	4.8	4.7	4.9	4.8
25 ... ..	4.9	4.8	4.8	4.9	4.9
26 ... ..	4.9	4.9	4.9	4.9	4.9
27 ... ..	5.0	4.9	4.9	4.9	4.9
28 ... ..	5.1	4.9	5.0	4.8	5.0
29 ... ..	5.1	5.0	5.1	4.8	5.0
30 ... ..	5.1	5.0	5.1	4.8	5.0
31 ... ..	5.1	5.0	5.2	4.8	5.0
Means ...	4.6	4.2	4.5	4.7	4.5



## CLOUD:

JUNE.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	5.1	5.1	5.2	4.8	5.1
2 ... ..	5.1	5.1	5.2	4.9	5.1
3 ... ..	5.2	5.2	5.3	4.9	5.2
4 ... ..	5.2	5.3	5.5	5.0	5.3
5 ... ..	5.3	5.4	5.6	5.0	5.3
6 ... ..	5.4	5.6	5.8	5.1	5.5
7 ... ..	5.5	5.7	6.0	5.2	5.6
8 ... ..	5.7	5.9	6.1	5.4	5.8
9 ... ..	5.8	6.0	6.3	5.5	5.9
10 ... ..	5.9	6.1	6.4	5.6	6.0
11 ... ..	6.0	6.2	6.6	5.8	6.2
12 ... ..	6.1	6.3	6.7	5.9	6.3
13 ... ..	6.2	6.4	6.8	6.0	6.4
14 ... ..	6.3	6.5	6.9	6.1	6.5
15 ... ..	6.4	6.6	7.0	6.2	6.6
16 ... ..	6.5	6.7	7.2	6.3	6.7
17 ... ..	6.7	6.7	7.3	6.3	6.8
18 ... ..	6.8	6.8	7.3	6.3	6.8
19 ... ..	6.8	6.9	7.4	6.4	6.9
20 ... ..	6.9	6.9	7.4	6.4	6.9
21 ... ..	6.9	6.9	7.4	6.4	6.9
22 ... ..	6.9	6.9	7.4	6.4	6.9
23 ... ..	6.9	6.9	7.4	6.4	6.9
24 ... ..	6.8	7.0	7.4	6.3	6.9
25 ... ..	6.8	7.0	7.4	6.3	6.9
26 ... ..	6.8	7.1	7.4	6.2	6.9
27 ... ..	6.8	7.1	7.4	6.2	6.9
28 ... ..	6.8	7.2	7.4	6.2	6.9
29 ... ..	6.8	7.2	7.4	6.2	6.9
30 ... ..	6.7	7.2	7.4	6.2	6.9
Means ...	6.2	6.4	6.7	5.8	6.2

## CLOUD.

JULY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	6.8	7.3	7.4	6.2	6.9
2 ... ..	6.8	7.3	7.5	6.3	7.0
3 ... ..	6.8	7.4	7.5	6.3	7.0
4 ... ..	6.9	7.4	7.5	6.4	7.1
5 ... ..	6.9	7.4	7.5	6.4	7.1
6 ... ..	6.9	7.4	7.5	6.5	7.1
7 ... ..	7.0	7.4	7.5	6.5	7.1
8 ... ..	7.0	7.4	7.5	6.5	7.1
9 ... ..	7.0	7.4	7.5	6.5	7.1
10 ... ..	7.0	7.4	7.5	6.6	7.1
11 ... ..	7.1	7.4	7.5	6.6	7.2
12 ... ..	7.1	7.4	7.5	6.6	7.2
13 ... ..	7.2	7.5	7.5	6.7	7.2
14 ... ..	7.2	7.5	7.5	6.7	7.2
15 ... ..	7.2	7.5	7.6	6.7	7.3
16 ... ..	7.3	7.5	7.6	6.7	7.3
17 ... ..	7.3	7.6	7.6	6.7	7.3
18 ... ..	7.3	7.6	7.6	6.6	7.3
19 ... ..	7.2	7.6	7.6	6.6	7.3
20 ... ..	7.2	7.5	7.6	6.6	7.2
21 ... ..	7.2	7.5	7.6	6.6	7.2
22 ... ..	7.1	7.5	7.6	6.6	7.2
23 ... ..	7.2	7.5	7.7	6.6	7.3
24 ... ..	7.2	7.5	7.7	6.6	7.3
25 ... ..	7.2	7.5	7.7	6.7	7.3
26 ... ..	7.2	7.5	7.7	6.7	7.3
27 ... ..	7.1	7.5	7.7	6.7	7.3
28 ... ..	7.1	7.5	7.7	6.7	7.3
29 ... ..	7.0	7.4	7.7	6.8	7.2
30 ... ..	7.0	7.4	7.7	6.8	7.2
31 ... ..	7.0	7.4	7.6	6.8	7.2
Mean ...	6.9	7.5	7.6	6.6	7.2

## CLOUD.

August.

DATE.			4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1	...	...	6.9	7.3	7.6	6.8	7.2
2	...	...	6.9	7.3	7.5	6.8	7.1
3	...	...	6.8	7.2	7.5	6.8	7.1
4	...	...	6.8	7.2	7.5	6.8	7.1
5	...	...	6.8	7.2	7.5	6.8	7.1
6	...	...	6.8	7.2	7.5	6.8	7.1
7	...	...	6.8	7.2	7.5	6.7	7.1
8	...	...	6.8	7.2	7.4	6.7	7.0
9	...	...	6.8	7.1	7.4	6.6	7.0
10	...	...	6.8	7.1	7.4	6.6	7.0
11	...	...	6.8	7.1	7.4	6.5	7.0
12	...	...	6.7	7.1	7.4	6.5	6.9
13	...	...	6.7	7.1	7.4	6.4	6.9
14	...	...	6.7	7.1	7.5	6.4	6.9
15	...	...	6.7	7.1	7.5	6.3	6.9
16	...	...	6.6	7.1	7.6	6.3	6.9
17	...	...	6.6	7.1	7.6	6.2	6.9
18	...	...	6.6	7.1	7.6	6.2	6.9
19	...	...	6.6	7.1	7.6	6.1	6.9
20	...	...	6.5	7.0	7.5	6.0	6.8
21	...	...	6.5	7.0	7.5	6.0	6.8
22	...	...	6.5	7.0	7.5	5.9	6.7
23	...	...	6.4	7.0	7.4	5.9	6.7
24	...	...	6.3	7.0	7.4	5.9	6.7
25	...	...	6.3	7.0	7.3	5.9	6.6
26	...	...	6.2	7.0	7.2	5.9	6.6
27	...	...	6.2	7.0	7.2	5.8	6.6
28	...	...	6.2	7.0	7.1	5.8	6.5
29	...	...	6.2	7.0	7.0	5.8	6.5
30	...	...	6.1	7.0	6.9	5.7	6.4
31	...	...	6.1	6.9	6.8	5.7	6.4
Means			6.6	7.1	7.4	6.3	6.8

## CLOUD.

SEPTEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	23 Hrs.	Mean.
1 ... ..	6.1	6.9	6.7	5.7	6.4
2 ... ..	6.1	6.9	6.7	5.7	6.4
3 ... ..	6.1	6.8	6.6	5.8	6.3
4 ... ..	6.0	6.8	6.6	5.8	6.3
5 ... ..	6.0	6.8	6.6	5.8	6.3
6 ... ..	6.0	6.8	6.6	5.8	6.3
7 ... ..	6.0	6.8	6.6	5.7	6.3
8 ... ..	6.0	6.8	6.6	5.7	6.3
9 ... ..	6.0	6.7	6.6	5.7	6.3
10 ... ..	6.0	6.7	6.6	5.7	6.3
11 ... ..	6.0	6.6	6.6	5.7	6.2
12 ... ..	6.0	6.6	6.7	5.7	6.3
13 ... ..	5.9	6.6	6.7	5.7	6.2
14 ... ..	5.9	6.6	6.8	5.7	6.3
15 ... ..	5.9	6.5	6.8	5.6	6.2
16 ... ..	5.8	6.5	6.8	5.6	6.2
17 ... ..	5.8	6.5	6.7	5.5	6.1
18 ... ..	5.7	6.5	6.7	5.4	6.1
19 ... ..	5.6	6.5	6.7	5.4	6.1
20 ... ..	5.6	6.4	6.6	5.4	6.0
21 ... ..	5.5	6.3	6.6	5.4	6.0
22 ... ..	5.5	6.3	6.5	5.3	5.9
23 ... ..	5.4	6.2	6.4	5.2	5.8
24 ... ..	5.3	6.1	6.3	5.2	5.7
25 ... ..	5.2	6.1	6.2	5.1	5.7
26 ... ..	5.1	6.0	6.2	5.0	5.6
27 ... ..	5.0	5.9	6.1	4.9	5.5
28 ... ..	4.9	5.8	5.9	4.9	5.4
29 ... ..	4.8	5.6	5.8	4.8	5.3
30 ... ..	4.7	5.5	5.7	4.7	5.2
Means ...	5.7	6.4	6.5	5.5	6.0

## CLOUD.

OCTOBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	4.6	5.4	5.6	4.6	5.1
2 ... ..	4.6	5.3	5.5	4.6	5.0
3 ... ..	4.5	5.2	5.5	4.5	4.9
4 ... ..	4.5	5.2	5.5	4.5	4.9
5 ... ..	4.5	5.1	5.4	4.4	4.9
6 ... ..	4.5	5.1	5.4	4.4	4.9
7 ... ..	4.4	5.1	5.4	4.4	4.8
8 ... ..	4.4	5.1	5.5	4.4	4.9
9 ... ..	4.5	5.1	5.5	4.4	4.9
10 ... ..	4.5	5.1	5.5	4.4	4.9
11 ... ..	4.5	5.1	5.4	4.3	4.8
12 ... ..	4.5	5.1	5.4	4.3	4.8
13 ... ..	4.5	5.0	5.3	4.3	4.8
14 ... ..	4.5	5.0	5.3	4.3	4.8
15 ... ..	4.6	5.1	5.3	4.4	4.9
16 ... ..	4.6	5.1	5.3	4.4	4.9
17 ... ..	4.7	5.1	5.3	4.4	4.9
18 ... ..	4.7	5.2	5.3	4.4	4.9
19 ... ..	4.7	5.2	5.3	4.4	4.9
20 ... ..	4.7	5.2	5.3	4.4	4.9
21 ... ..	4.6	5.2	5.2	4.4	4.9
22 ... ..	4.6	5.1	5.2	4.4	4.8
23 ... ..	4.5	5.1	5.1	4.4	4.8
24 ... ..	4.5	5.1	5.1	4.5	4.8
25 ... ..	4.6	5.1	5.2	4.6	4.9
26 ... ..	4.6	5.2	5.2	4.6	4.9
27 ... ..	4.7	5.3	5.2	4.7	5.0
28 ... ..	4.7	5.3	5.3	4.7	5.0
29 ... ..	4.7	5.4	5.3	4.7	5.0
30 ... ..	4.7	5.4	5.3	4.7	5.0
31 ... ..	4.7	5.4	5.2	4.7	5.0
Means ...	4.6	5.2	5.3	4.5	4.9

## CLOUD.

NOVEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	4.6	5.3	5.1	4.7	4.9
2 ... ..	4.5	5.2	5.0	4.6	4.8
3 ... ..	4.4	5.1	4.9	4.5	4.7
4 ... ..	4.3	5.0	4.8	4.4	4.6
5 ... ..	4.2	4.8	4.6	4.2	4.5
6 ... ..	4.1	4.7	4.5	4.1	4.4
7 ... ..	3.9	4.5	4.3	3.9	4.2
8 ... ..	3.7	4.3	4.1	3.6	3.9
9 ... ..	3.5	4.1	4.0	3.4	3.8
10 ... ..	3.2	3.9	3.8	3.2	3.5
11 ... ..	3.0	3.8	3.7	3.1	3.4
12 ... ..	2.8	3.7	3.6	3.0	3.3
13 ... ..	2.7	3.6	3.6	2.9	3.2
14 ... ..	2.6	3.5	3.5	2.8	3.1
15 ... ..	2.5	3.4	3.5	2.7	3.0
16 ... ..	2.4	3.3	3.5	2.7	3.0
17 ... ..	2.4	3.3	3.5	2.7	3.0
18 ... ..	2.3	3.3	3.5	2.7	3.0
19 ... ..	2.3	3.3	3.5	2.6	2.9
20 ... ..	2.3	3.3	3.4	2.6	2.9
21 ... ..	2.3	3.3	3.4	2.7	2.9
22 ... ..	2.4	3.3	3.4	2.7	3.0
23 ... ..	2.4	3.3	3.4	2.7	3.0
24 ... ..	2.4	3.3	3.4	2.7	3.0
25 ... ..	2.5	3.3	3.4	2.7	3.0
26 ... ..	2.5	3.3	3.3	2.7	3.0
27 ... ..	2.6	3.3	3.3	2.7	3.0
28 ... ..	2.6	3.3	3.3	2.7	3.0
29 ... ..	2.6	3.3	3.2	2.7	3.0
30 ... ..	2.6	3.3	3.2	2.7	3.0
Means ...	3.0	3.8	3.8	3.2	3.5

## CLOUD.

FEBRUARY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	1.4	2.0	1.4	1.6	1.6
2 ... ..	1.4	2.0	1.4	1.5	1.6
3 ... ..	1.4	2.0	1.4	1.5	1.6
4 ... ..	1.5	2.0	1.4	1.5	1.6
5 ... ..	1.5	2.1	1.4	1.5	1.6
6 ... ..	1.5	2.1	1.4	1.5	1.6
7 ... ..	1.5	2.1	1.4	1.5	1.6
8 ... ..	1.5	2.2	1.4	1.5	1.7
9 ... ..	1.5	2.2	1.4	1.6	1.7
10 ... ..	1.5	2.3	1.4	1.6	1.7
11 ... ..	1.5	2.3	1.4	1.6	1.7
12 ... ..	1.5	2.3	1.5	1.6	1.7
13 ... ..	1.5	2.3	1.5	1.6	1.7
14 ... ..	1.4	2.3	1.5	1.6	1.7
15 ... ..	1.4	2.3	1.5	1.6	1.7
16 ... ..	1.4	2.3	1.5	1.6	1.7
17 ... ..	1.5	2.3	1.5	1.6	1.7
18 ... ..	1.5	2.3	1.5	1.6	1.7
19 ... ..	1.4	2.2	1.5	1.6	1.7
20 ... ..	1.4	2.2	1.5	1.6	1.7
21 ... ..	1.4	2.1	1.5	1.6	1.7
22 ... ..	1.4	2.1	1.5	1.6	1.7
23 ... ..	1.4	2.0	1.5	1.6	1.6
24 ... ..	1.4	2.0	1.5	1.6	1.6
25 ... ..	1.4	1.9	1.5	1.6	1.6
26 ... ..	1.4	1.9	1.5	1.6	1.6
27 ... ..	1.5	2.0	1.6	1.6	1.7
28 ... ..	1.5	2.0	1.7	1.7	1.7
Means ...	1.5	2.1	1.5	1.6	1.7

## CLOUD.

MARCH.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	1.6	2.0	1.7	1.7	1.8
2 ... ..	1.7	2.0	1.8	1.8	1.8
3 ... ..	1.7	2.0	1.8	1.8	1.8
4 ... ..	1.7	2.0	1.8	1.8	1.8
5 ... ..	1.8	1.9	1.9	1.8	1.9
6 ... ..	1.8	1.9	1.9	1.9	1.9
7 ... ..	1.8	1.9	2.0	1.9	1.9
8 ... ..	1.8	1.9	2.0	1.9	1.9
9 ... ..	1.8	2.0	2.1	1.9	2.0
10 ... ..	1.9	2.0	2.2	2.0	2.0
11 ... ..	2.0	2.0	2.3	2.0	2.1
12 ... ..	2.0	2.0	2.3	2.1	2.1
13 ... ..	2.1	2.0	2.4	2.1	2.2
14 ... ..	2.2	2.0	2.4	2.1	2.2
15 ... ..	2.2	2.0	2.4	2.1	2.2
16 ... ..	2.2	2.0	2.4	2.0	2.2
17 ... ..	2.1	2.0	2.4	2.1	2.2
18 ... ..	2.2	2.0	2.4	2.1	2.2
19 ... ..	2.2	2.0	2.5	2.2	2.2
20 ... ..	2.3	2.0	2.5	2.2	2.3
21 ... ..	2.4	2.1	2.5	2.3	2.3
22 ... ..	2.4	2.1	2.6	2.4	2.4
23 ... ..	2.5	2.1	2.6	2.5	2.4
24 ... ..	2.5	2.1	2.6	2.5	2.4
25 ... ..	2.5	2.1	2.6	2.5	2.4
26 ... ..	2.5	2.1	2.6	2.5	2.4
27 ... ..	2.4	2.1	2.6	2.6	2.4
28 ... ..	2.4	2.0	2.6	2.6	2.4
29 ... ..	2.5	2.0	2.6	2.7	2.5
30 ... ..	2.5	2.0	2.6	2.7	2.5
31 ... ..	2.5	2.0	2.7	2.7	2.5
Mean ...	2.1	2.0	2.3	2.2	2.2



## CLOUD.

APRIL.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	2.5	2.0	2.7	2.8	2.5
2 ... ..	2.5	2.1	2.7	2.8	2.5
3 ... ..	2.5	2.1	2.8	2.9	2.6
4 ... ..	2.6	2.1	2.8	2.9	2.6
5 ... ..	2.6	2.1	2.8	2.9	2.6
6 ... ..	2.6	2.2	2.9	2.9	2.7
7 ... ..	2.6	2.2	2.9	2.9	2.7
8 ... ..	2.6	2.2	2.9	3.0	2.7
9 ... ..	2.7	2.3	3.0	3.1	2.8
10 ... ..	2.8	2.3	3.0	3.1	2.8
11 ... ..	2.9	2.4	3.1	3.2	2.9
12 ... ..	2.9	2.4	3.2	3.2	2.9
13 ... ..	3.0	2.4	3.3	3.3	3.0
14 ... ..	3.0	2.5	3.4	3.4	3.1
15 ... ..	3.0	2.5	3.5	3.4	3.1
16 ... ..	3.0	2.5	3.5	3.5	3.1
17 ... ..	3.1	2.6	3.6	3.5	3.2
18 ... ..	3.1	2.6	3.6	3.5	3.2
19 ... ..	3.2	2.7	3.7	3.5	3.3
20 ... ..	3.2	2.7	3.7	3.6	3.3
21 ... ..	3.3	2.7	3.8	3.6	3.4
22 ... ..	3.3	2.7	3.8	3.6	3.4
23 ... ..	3.4	2.7	3.8	3.5	3.4
24 ... ..	3.4	2.7	3.8	3.5	3.4
25 ... ..	3.4	2.7	3.8	3.6	3.4
26 ... ..	3.4	2.7	3.8	3.6	3.4
27 ... ..	3.5	2.8	3.8	3.6	3.4
28 ... ..	3.6	2.8	3.8	3.7	3.5
29 ... ..	3.6	2.8	3.8	3.8	3.5
30 ... ..	3.7	2.9	3.8	3.8	3.6
Means ...	3.0	2.5	3.4	3.3	3.1

## CLOUD.

MAY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	3.8	3.0	3.8	3.9	3.6
2 ... ..	3.9	3.0	3.9	3.9	3.7
3 ... ..	3.9	3.1	3.9	4.0	3.7
4 ... ..	3.9	3.1	4.0	4.1	3.8
5 ... ..	4.0	3.2	4.0	4.2	3.9
6 ... ..	4.1	3.3	4.1	4.3	4.0
7 ... ..	4.1	3.4	4.2	4.4	4.0
8 ... ..	4.3	3.5	4.3	4.5	4.2
9 ... ..	4.4	3.7	4.3	4.6	4.3
10 ... ..	4.5	3.8	4.4	4.6	4.3
11 ... ..	4.6	3.9	4.4	4.7	4.4
12 ... ..	4.6	4.0	4.4	4.7	4.4
13 ... ..	4.6	4.1	4.4	4.8	4.5
14 ... ..	4.6	4.2	4.5	4.8	4.5
15 ... ..	4.7	4.2	4.5	4.8	4.6
16 ... ..	4.7	4.3	4.6	4.8	4.6
17 .. ...	4.8	4.4	4.6	4.9	4.7
18 ... ..	4.8	4.5	4.7	4.9	4.7
19 ... ..	4.9	4.6	4.7	4.9	4.8
20 ... ..	4.9	4.7	4.7	4.9	4.8
21 ... ..	4.9	4.7	4.7	4.9	4.8
22 ... ..	4.9	4.8	4.7	4.9	4.8
23 ... ..	4.9	4.8	4.7	4.9	4.8
24 ... ..	4.9	4.8	4.7	4.9	4.8
25 ... ..	4.9	4.8	4.8	4.9	4.9
26 ... ..	4.9	4.9	4.9	4.9	4.9
27 ... ..	5.0	4.9	4.9	4.9	4.9
28 ... ..	5.1	4.9	5.0	4.8	5.0
29 ... ..	5.1	5.0	5.1	4.8	5.0
30 ... ..	5.1	5.0	5.1	4.8	5.0
31 ... ..	5.1	5.0	5.2	4.8	5.0
Means ...	4.6	4.2	4.5	4.7	4.5

## CLOUD:

JUNE.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	5.1	5.1	5.2	4.8	5.1
2 ... ..	5.1	5.1	5.2	4.9	5.1
3 ... ..	5.2	5.2	5.3	4.9	5.2
4 ... ..	5.2	5.3	5.5	5.0	5.3
5 ... ..	5.3	5.4	5.6	5.0	5.3
6 ... ..	5.4	5.6	5.8	5.1	5.5
7 ... ..	5.5	5.7	6.0	5.2	5.6
8 ... ..	5.7	5.9	6.1	5.4	5.8
9 ... ..	5.8	6.0	6.3	5.5	5.9
10 ... ..	5.9	6.1	6.4	5.6	6.0
11 ... ..	6.0	6.2	6.6	5.8	6.2
12 ... ..	6.1	6.3	6.7	5.9	6.3
13 ... ..	6.2	6.4	6.8	6.0	6.4
14 ... ..	6.3	6.5	6.9	6.1	6.5
15 ... ..	6.4	6.6	7.0	6.2	6.6
16 ... ..	6.5	6.7	7.2	6.3	6.7
17 ... ..	6.7	6.7	7.3	6.3	6.8
18 ... ..	6.8	6.8	7.3	6.3	6.8
19 ... ..	6.8	6.9	7.4	6.4	6.9
20 ... ..	6.9	6.9	7.4	6.4	6.9
21 ... ..	6.9	6.9	7.4	6.4	6.9
22 ... ..	6.9	6.9	7.4	6.4	6.9
23 ... ..	6.9	6.9	7.4	6.4	6.9
24 ... ..	6.8	7.0	7.4	6.3	6.9
25 ... ..	6.8	7.0	7.4	6.3	6.9
26 ... ..	6.8	7.1	7.4	6.2	6.9
27 ... ..	6.8	7.1	7.4	6.2	6.9
28 ... ..	6.8	7.2	7.4	6.2	6.9
29 ... ..	6.8	7.2	7.4	6.2	6.9
30 ... ..	6.7	7.2	7.4	6.2	6.9
Means ...	6.2	6.4	6.7	5.8	6.2

## CLOUD.

JULY.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	6.8	7.3	7.4	6.2	6.9
2 ... ..	6.8	7.3	7.5	6.3	7.0
3 ... ..	6.8	7.4	7.5	6.3	7.0
4 ... ..	6.9	7.4	7.5	6.4	7.1
5 ... ..	6.9	7.4	7.5	6.4	7.1
6 ... ..	6.9	7.4	7.5	6.5	7.1
7 ... ..	7.0	7.4	7.5	6.5	7.1
8 ... ..	7.0	7.4	7.5	6.5	7.1
9 ... ..	7.0	7.4	7.5	6.5	7.1
10 ... ..	7.0	7.4	7.5	6.6	7.1
11 ... ..	7.1	7.4	7.5	6.6	7.2
12 ... ..	7.1	7.4	7.5	6.6	7.2
13 ... ..	7.2	7.5	7.5	6.7	7.2
14 ... ..	7.2	7.5	7.5	6.7	7.2
15 ... ..	7.2	7.5	7.6	6.7	7.3
16 ... ..	7.3	7.5	7.6	6.7	7.3
17 ... ..	7.3	7.6	7.6	6.7	7.3
18 ... ..	7.3	7.6	7.6	6.6	7.3
19 ... ..	7.2	7.6	7.6	6.6	7.3
20 ... ..	7.2	7.5	7.6	6.6	7.2
21 ... ..	7.2	7.5	7.6	6.6	7.2
22 ... ..	7.1	7.5	7.6	6.6	7.2
23 ... ..	7.2	7.5	7.7	6.6	7.3
24 ... ..	7.2	7.5	7.7	6.6	7.3
25 ... ..	7.2	7.5	7.7	6.7	7.3
26 ... ..	7.2	7.5	7.7	6.7	7.3
27 ... ..	7.1	7.5	7.7	6.7	7.3
28 ... ..	7.1	7.5	7.7	6.7	7.3
29 ... ..	7.0	7.4	7.7	6.8	7.2
30 ... ..	7.0	7.4	7.7	6.8	7.2
31 ... ..	7.0	7.4	7.6	6.8	7.2
Mean ...	6.9	7.5	7.6	6.6	7.2

## CLOUD.

AUGUST.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	6.9	7.3	7.6	6.8	7.2
2 ... ..	6.9	7.3	7.5	6.8	7.1
3 ... ..	6.8	7.2	7.5	6.8	7.1
4 ... ..	6.8	7.2	7.5	6.8	7.1
5 ... ..	6.8	7.2	7.5	6.8	7.1
6 ... ..	6.8	7.2	7.5	6.8	7.1
7 ... ..	6.8	7.2	7.5	6.7	7.1
8 ... ..	6.8	7.2	7.4	6.7	7.0
9 ... ..	6.8	7.1	7.4	6.6	7.0
10 ... ..	6.8	7.1	7.4	6.6	7.0
11 ... ..	6.8	7.1	7.4	6.5	7.0
12 ... ..	6.7	7.1	7.4	6.5	6.9
13 ... ..	6.7	7.1	7.4	6.4	6.9
14 ... ..	6.7	7.1	7.5	6.4	6.9
15 ... ..	6.7	7.1	7.5	6.3	6.9
16 ... ..	6.6	7.1	7.6	6.3	6.9
17 ... ..	6.6	7.1	7.6	6.3	6.9
18 ... ..	6.6	7.1	7.6	6.3	6.9
19 ... ..	6.6	7.1	7.6	6.1	6.9
20 ... ..	6.6	7.0	7.5	6.0	6.8
21 ... ..	6.6	7.0	7.5	6.0	6.8
22 ... ..	6.6	7.0	7.5	5.9	6.7
23 ... ..	6.4	7.0	7.4	5.9	6.7
24 ... ..	6.3	7.0	7.4	5.9	6.7
25 ... ..	6.3	7.0	7.3	5.9	6.6
26 ... ..	6.2	7.0	7.2	5.9	6.6
27 ... ..	6.2	7.0	7.2	5.8	6.6
28 ... ..	6.2	7.0	7.1	5.8	6.5
29 ... ..	6.2	7.0	7.0	5.8	6.5
30 ... ..	6.1	7.0	6.9	5.7	6.4
31 ... ..	6.1	6.9	6.8	5.7	6.4
Means ...	6.6	7.1	7.4	6.3	6.8

## CLOUD.

SEPTEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	23 Hrs.	Mean.
1 ... ..	6.1	6.9	6.7	5.7	6.4
2 ... ..	6.1	6.9	6.7	5.7	6.4
3 ... ..	6.1	6.8	6.6	5.8	6.3
4 ... ..	6.0	6.8	6.6	5.8	6.3
5 ... ..	6.0	6.8	6.6	5.8	6.3
6 ... ..	6.0	6.8	6.6	5.8	6.3
7 ... ..	6.0	6.8	6.6	5.7	6.3
8 ... ..	6.0	6.8	6.6	5.7	6.3
9 ... ..	6.0	6.7	6.6	5.7	6.3
10 ... ..	6.0	6.7	6.6	5.7	6.3
11 ... ..	6.0	6.6	6.6	5.7	6.2
12 ... ..	6.0	6.6	6.7	5.7	6.3
13 ... ..	5.9	6.6	6.7	5.7	6.2
14 ... ..	5.9	6.6	6.8	5.7	6.3
15 ... ..	5.9	6.5	6.8	5.6	6.2
16 ... ..	5.8	6.5	6.8	5.6	6.2
17 ... ..	5.8	6.5	6.7	5.5	6.1
18 ... ..	5.7	6.5	6.7	5.4	6.1
19 ... ..	5.6	6.5	6.7	5.4	6.1
20 ... ..	5.6	6.4	6.6	5.4	6.0
21 ... ..	5.5	6.3	6.6	5.4	6.0
22 ... ..	5.5	6.3	6.5	5.3	5.9
23 ... ..	5.4	6.2	6.4	5.2	5.8
24 ... ..	5.3	6.1	6.3	5.2	5.7
25 ... ..	5.2	6.1	6.2	5.1	5.7
26 ... ..	5.1	6.0	6.2	5.0	5.6
27 ... ..	5.0	5.9	6.1	4.9	5.5
28 ... ..	4.9	5.8	5.9	4.9	5.4
29 ... ..	4.8	5.6	5.8	4.8	5.3
30 ... ..	4.7	5.5	5.7	4.7	5.2
Means ...	5.7	6.4	6.5	5.5	6.0

## CLOUD.

OCTOBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	4.6	5.4	5.6	4.6	5.1
2 ... ..	4.6	5.3	5.5	4.6	5.0
3 ... ..	4.5	5.2	5.5	4.5	4.9
4 ... ..	4.5	5.2	5.5	4.5	4.9
5 ... ..	4.5	5.1	5.4	4.4	4.9
6 ... ..	4.5	5.1	5.4	4.4	4.9
7 ... ..	4.4	5.1	5.4	4.4	4.8
8 ... ..	4.4	5.1	5.5	4.4	4.9
9 ... ..	4.5	5.1	5.5	4.4	4.9
10 ... ..	4.5	5.1	5.5	4.4	4.9
11 ... ..	4.5	5.1	5.4	4.3	4.8
12 ... ..	4.5	5.1	5.4	4.3	4.8
13 ... ..	4.5	5.0	5.3	4.3	4.8
14 ... ..	4.5	5.0	5.3	4.3	4.8
15 ... ..	4.6	5.1	5.3	4.4	4.9
16 ... ..	4.6	5.1	5.3	4.4	4.9
17 ... ..	4.7	5.1	5.3	4.4	4.9
18 ... ..	4.7	5.2	5.3	4.4	4.9
19 ... ..	4.7	5.2	5.3	4.4	4.9
20 ... ..	4.7	5.2	5.3	4.4	4.9
21 ... ..	4.6	5.2	5.2	4.4	4.9
22 ... ..	4.6	5.1	5.2	4.4	4.8
23 ... ..	4.5	5.1	5.1	4.4	4.8
24 ... ..	4.5	5.1	5.1	4.5	4.8
25 ... ..	4.6	5.1	5.2	4.6	4.9
26 ... ..	4.6	5.2	5.2	4.6	4.9
27 ... ..	4.7	5.3	5.2	4.7	5.0
28 ... ..	4.7	5.3	5.2	4.7	5.0
29 ... ..	4.7	5.4	5.3	4.7	5.0
30 ... ..	4.7	5.4	5.3	4.7	5.0
31 ... ..	4.7	5.4	5.2	4.7	5.0
Means ...	4.6	5.2	5.3	4.5	4.9

## CLOUD.

NOVEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	4.6	5.3	5.1	4.7	4.9
2 ... ..	4.5	5.2	5.0	4.6	4.8
3 ... ..	4.4	5.1	4.9	4.5	4.7
4 ... ..	4.3	5.0	4.8	4.4	4.6
5 ... ..	4.2	4.8	4.6	4.2	4.5
6 ... ..	4.1	4.7	4.5	4.1	4.4
7 ... ..	3.9	4.5	4.3	3.9	4.2
8 ... ..	3.7	4.3	4.1	3.6	3.9
9 ... ..	3.5	4.1	4.0	3.4	3.8
10 ... ..	3.2	3.9	3.8	3.2	3.5
11 ... ..	3.0	3.8	3.7	3.1	3.4
12 ... ..	2.8	3.7	3.6	3.0	3.3
13 ... ..	2.7	3.6	3.6	2.9	3.2
14 ... ..	2.6	3.5	3.5	2.8	3.1
15 ... ..	2.5	3.4	3.5	2.7	3.0
16 ... ..	2.4	3.3	3.5	2.7	3.0
17 ... ..	2.4	3.3	3.5	2.7	3.0
18 ... ..	2.3	3.3	3.5	2.7	3.0
19 ... ..	2.3	3.3	3.5	2.6	2.9
20 ... ..	2.3	3.3	3.4	2.6	2.9
21 ... ..	2.3	3.3	3.4	2.7	2.9
22 ... ..	2.4	3.3	3.4	2.7	3.0
23 ... ..	2.4	3.3	3.4	2.7	3.0
24 ... ..	2.4	3.3	3.4	2.7	3.0
25 ... ..	2.5	3.3	3.4	2.7	3.0
26 ... ..	2.5	3.3	3.3	2.7	3.0
27 ... ..	2.6	3.3	3.3	2.7	3.0
28 ... ..	2.6	3.3	3.3	2.7	3.0
29 ... ..	2.6	3.3	3.2	2.7	3.0
30 ... ..	2.6	3.3	3.2	2.7	3.0
Means ...	3.0	3.8	3.8	3.2	3.5



## CLOUD.

DECEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	2.7	3.3	3.2	2.7	3.0
2 ... ..	2.6	3.3	3.3	2.7	3.0
3 ... ..	2.6	3.3	3.3	2.7	3.0
4 ... ..	2.6	3.3	3.3	2.7	3.0
5 ... ..	2.6	3.3	3.4	2.7	3.0
6 ... ..	2.6	3.4	3.4	2.7	3.0
7 ... ..	2.6	3.4	3.5	2.7	3.1
8 ... ..	2.6	3.4	3.5	2.7	3.1
9 ... ..	2.6	3.4	3.4	2.7	3.0
10 ... ..	2.6	3.4	3.4	2.7	3.0
11 ... ..	2.5	3.3	3.3	2.6	2.9
12 ... ..	2.5	3.3	3.3	2.6	2.9
13 ... ..	2.4	3.2	3.1	2.4	2.8
14 ... ..	2.3	3.1	3.0	2.3	2.7
15 ... ..	2.3	3.0	2.9	2.2	2.6
16 ... ..	2.1	2.9	2.8	2.2	2.5
17 ... ..	2.1	2.8	2.8	2.1	2.5
18 ... ..	2.1	2.8	2.7	2.1	2.4
19 ... ..	2.1	2.7	2.6	2.0	2.4
20 ... ..	2.1	2.6	2.5	2.0	2.3
21 ... ..	2.0	2.6	2.5	1.9	2.3
22 ... ..	2.0	2.5	2.4	1.9	2.2
23 ... ..	1.9	2.5	2.4	1.8	2.2
24 ... ..	1.8	2.4	2.3	1.8	2.1
25 ... ..	1.8	2.4	2.3	1.7	2.1
26 ... ..	1.7	2.3	2.2	1.7	2.0
27 ... ..	1.7	2.3	2.2	1.7	2.0
28 ... ..	1.8	2.3	2.2	1.7	2.0
29 ... ..	1.8	2.4	2.3	1.8	2.1
30 ... ..	1.8	2.4	2.2	1.8	2.1
31 ... ..	1.8	2.3	2.2	1.7	2.0
Means ...	2.2	2.9	2.6	2.2	2.5

Max

30  
20  
10  
0  
-10  
-20  
-30  
-40  
-50  
-60  
-70  
-80  
-90  
-100

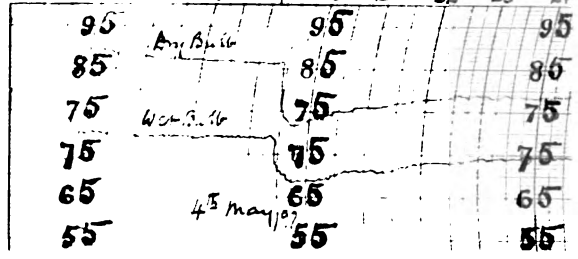
Barograph

16 17 18 19 20 21 22 23 24

4<sup>th</sup> May 1907

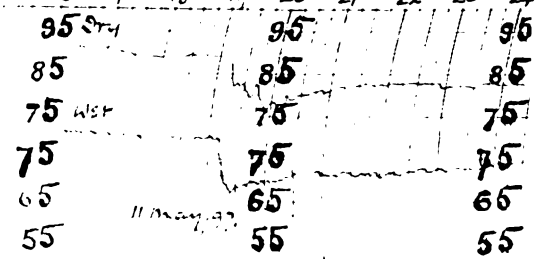
Thermograph

16 17 18 19 20 21 22 23 24

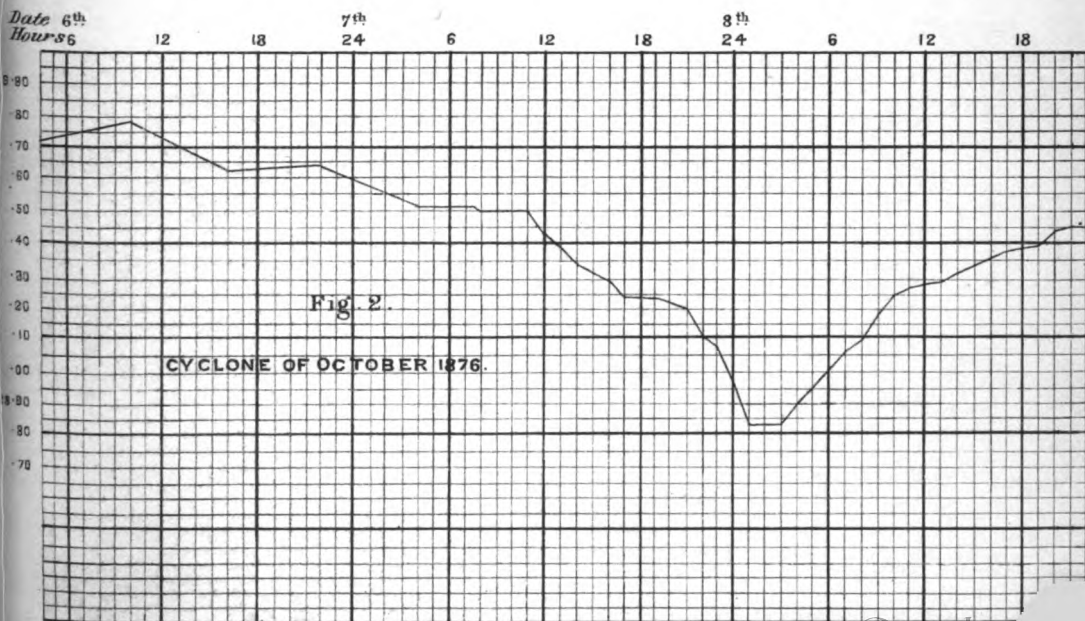
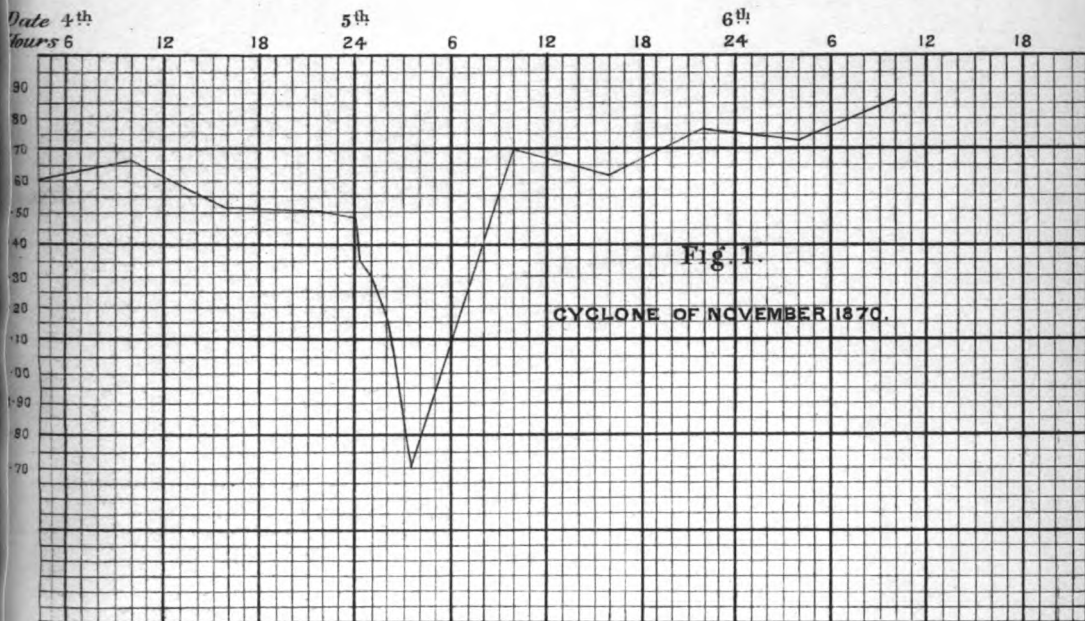


Thermograph

16 17 18 19 20 21 22 23 24

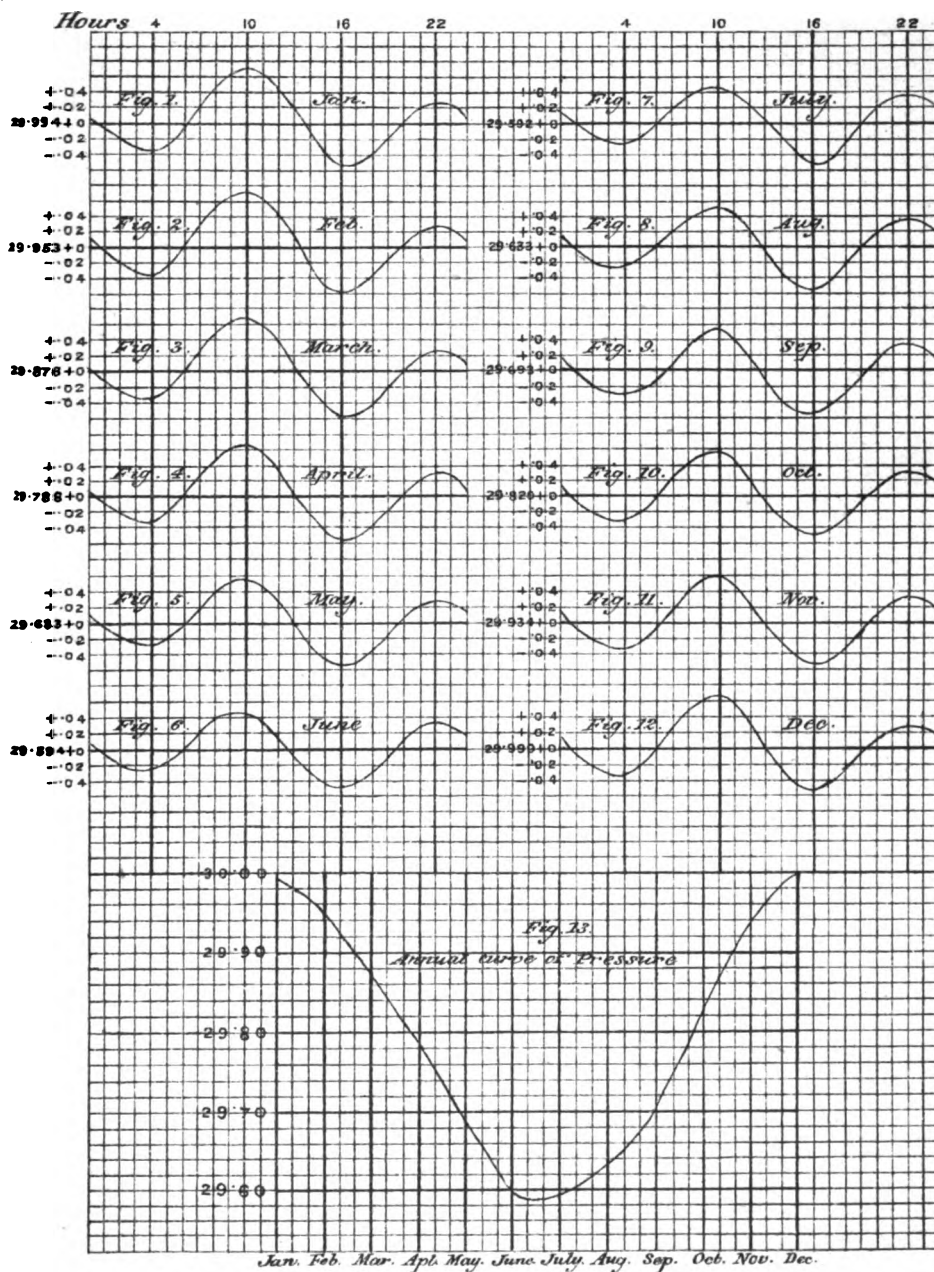






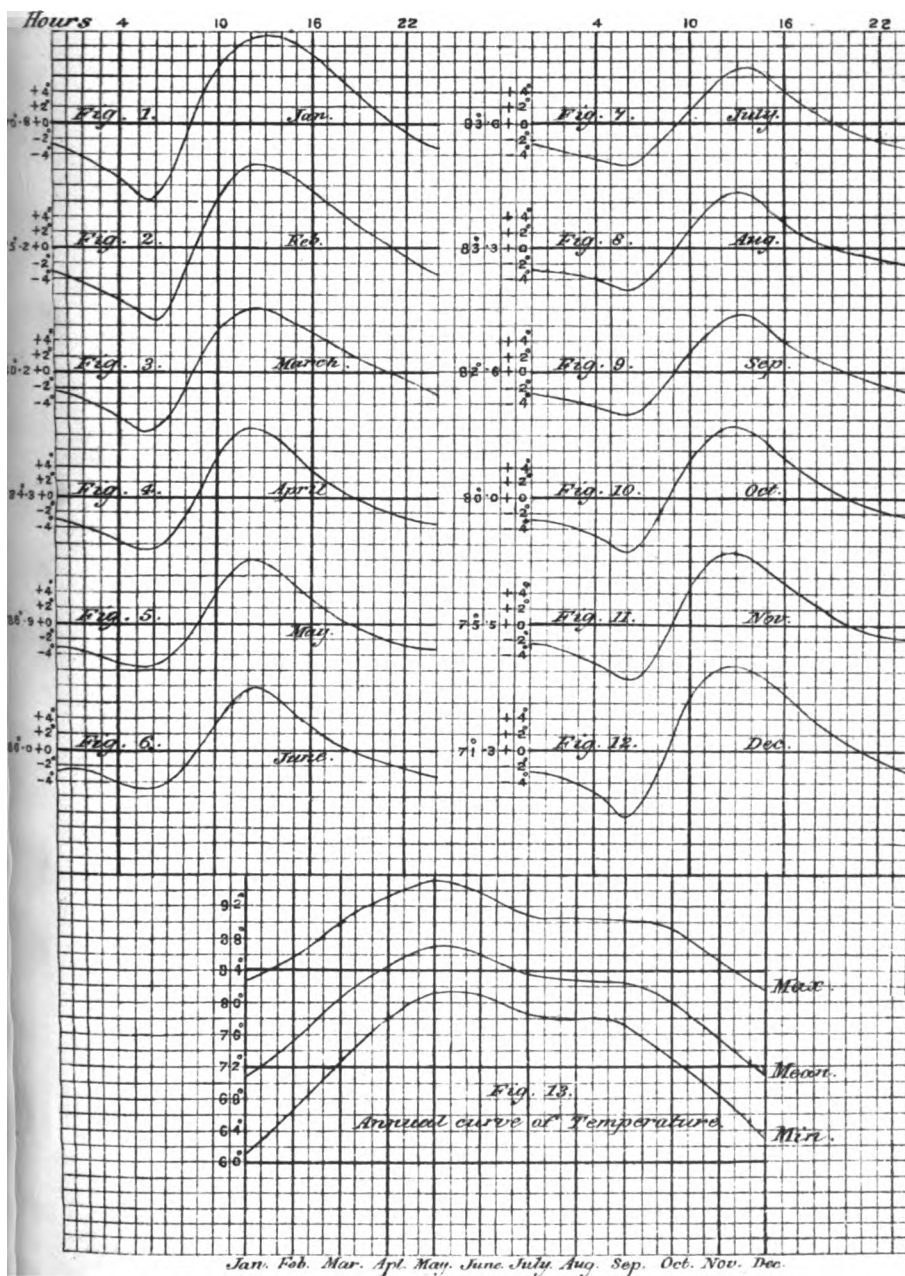


DIURNAL VARIATION OF PRESSURE, VIZAGAPATAM.





**DIURNAL VARIATION OF TEMPERATURE, VIZAGAPATAM.**





## CLOUD.

OCTOBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	4.6	5.4	5.6	4.6	5.1
2 ... ..	4.6	5.3	5.5	4.6	5.0
3 ... ..	4.5	5.2	5.5	4.5	4.9
4 ... ..	4.5	5.2	5.5	4.5	4.9
5 ... ..	4.5	5.1	5.4	4.4	4.9
6 ... ..	4.5	5.1	5.4	4.4	4.9
7 ... ..	4.4	5.1	5.4	4.4	4.8
8 ... ..	4.4	5.1	5.5	4.4	4.9
9 ... ..	4.5	5.1	5.5	4.4	4.9
10 ... ..	4.5	5.1	5.5	4.4	4.9
11 ... ..	4.5	5.1	5.4	4.3	4.8
12 ... ..	4.5	5.1	5.4	4.3	4.8
13 ... ..	4.5	5.0	5.3	4.3	4.8
14 ... ..	4.5	5.0	5.3	4.3	4.8
15 ... ..	4.6	5.1	5.3	4.4	4.9
16 ... ..	4.6	5.1	5.3	4.4	4.9
17 ... ..	4.7	5.1	5.3	4.4	4.9
18 ... ..	4.7	5.2	5.3	4.4	4.9
19 ... ..	4.7	5.2	5.3	4.4	4.9
20 ... ..	4.7	5.2	5.3	4.4	4.9
21 ... ..	4.6	5.2	5.2	4.4	4.9
22 ... ..	4.6	5.1	5.2	4.4	4.8
23 ... ..	4.5	5.1	5.1	4.4	4.8
24 ... ..	4.5	5.1	5.1	4.5	4.8
25 ... ..	4.6	5.1	5.2	4.6	4.9
26 ... ..	4.6	5.2	5.2	4.6	4.9
27 ... ..	4.7	5.3	5.2	4.7	5.0
28 ... ..	4.7	5.3	5.3	4.7	5.0
29 ... ..	4.7	5.4	5.3	4.7	5.0
30 ... ..	4.7	5.4	5.3	4.7	5.0
31 ... ..	4.7	5.4	5.2	4.7	5.0
Means ...	4.6	5.2	5.3	4.5	4.9

## CLOUD.

NOVEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	4.6	5.3	5.1	4.7	4.9
2 ... ..	4.5	5.2	5.0	4.6	4.8
3 ... ..	4.4	5.1	4.9	4.5	4.7
4 ... ..	4.3	5.0	4.8	4.4	4.6
5 ... ..	4.2	4.8	4.6	4.2	4.5
6 ... ..	4.1	4.7	4.5	4.1	4.4
7 ... ..	3.9	4.5	4.3	3.9	4.2
8 ... ..	3.7	4.3	4.1	3.6	3.9
9 ... ..	3.5	4.1	4.0	3.4	3.8
10 ... ..	3.2	3.9	3.8	3.2	3.5
11 ... ..	3.0	3.8	3.7	3.1	3.4
12 ... ..	2.8	3.7	3.6	3.0	3.3
13 ... ..	2.7	3.6	3.6	2.9	3.2
14 ... ..	2.6	3.5	3.5	2.8	3.1
15 ... ..	2.5	3.4	3.5	2.7	3.0
16 ... ..	2.4	3.3	3.5	2.7	3.0
17 ... ..	2.4	3.3	3.5	2.7	3.0
18 ... ..	2.3	3.3	3.5	2.7	3.0
19 ... ..	2.3	3.3	3.5	2.6	2.9
20 ... ..	2.3	3.3	3.4	2.6	2.9
21 ... ..	2.3	3.3	3.4	2.7	2.9
22 ... ..	2.4	3.3	3.4	2.7	3.0
23 ... ..	2.4	3.3	3.4	2.7	3.0
24 ... ..	2.4	3.3	3.4	2.7	3.0
25 ... ..	2.5	3.3	3.4	2.7	3.0
26 ... ..	2.5	3.3	3.3	2.7	3.0
27 ... ..	2.6	3.3	3.3	2.7	3.0
28 ... ..	2.6	3.3	3.3	2.7	3.0
29 ... ..	2.6	3.3	3.2	2.7	3.0
30 ... ..	2.6	3.3	3.2	2.7	3.0
Means ...	3.0	3.3	3.3	3.2	3.5

## CLOUD.

DECEMBER.

DATE.	4 Hrs.	10 Hrs.	16 Hrs.	22 Hrs.	Mean.
1 ... ..	2.7	3.3	3.2	2.7	3.0
2 ... ..	2.6	3.3	3.3	2.7	3.0
3 ... ..	2.6	3.3	3.3	2.7	3.0
4 ... ..	2.6	3.3	3.3	2.7	3.0
5 ... ..	2.6	3.3	3.4	2.7	3.0
6 ... ..	2.6	3.4	3.4	2.7	3.0
7 ... ..	2.6	3.4	3.5	2.7	3.1
8 ... ..	2.6	3.4	3.5	2.7	3.1
9 ... ..	2.6	3.4	3.4	2.7	3.0
10 ... ..	2.6	3.4	3.4	2.7	3.0
11 ... ..	2.5	3.3	3.3	2.6	2.9
12 ... ..	2.5	3.3	3.3	2.5	2.9
13 ... ..	2.4	3.2	3.1	2.4	2.8
14 ... ..	2.3	3.1	3.0	2.3	2.7
15 ... ..	2.2	3.0	2.9	2.2	2.6
16 ... ..	2.1	2.9	2.8	2.2	2.5
17 ... ..	2.1	2.8	2.8	2.1	2.5
18 ... ..	2.1	2.8	2.7	2.1	2.4
19 ... ..	2.1	2.7	2.6	2.0	2.4
20 ... ..	2.1	2.6	2.5	2.0	2.3
21 ... ..	2.0	2.6	2.5	1.9	2.3
22 ... ..	2.0	2.5	2.4	1.9	2.2
23 ... ..	1.9	2.5	2.4	1.8	2.2
24 ... ..	1.8	2.4	2.3	1.8	2.1
25 ... ..	1.8	2.4	2.3	1.7	2.1
26 ... ..	1.7	2.3	2.2	1.7	2.0
27 ... ..	1.7	2.3	2.2	1.7	2.0
28 ... ..	1.8	2.3	2.2	1.7	2.0
29 ... ..	1.8	2.4	2.2	1.8	2.1
30 ... ..	1.8	2.4	2.2	1.8	2.1
31 ... ..	1.8	2.3	2.2	1.7	2.0
Means ...	2.2	2.9	2.8	2.2	2.5

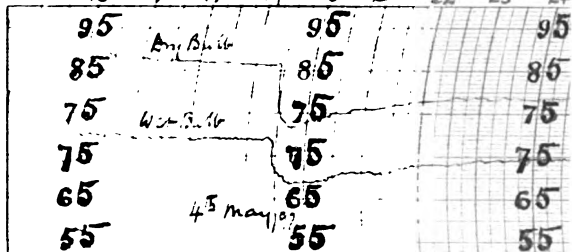
Barograph

Hours 16 17 18 19 20 21 22 23 24

4.5 May 1917.

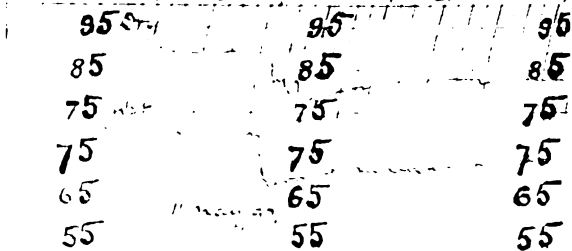
Thermograph

16 17 18 19 20 21 22 23 24

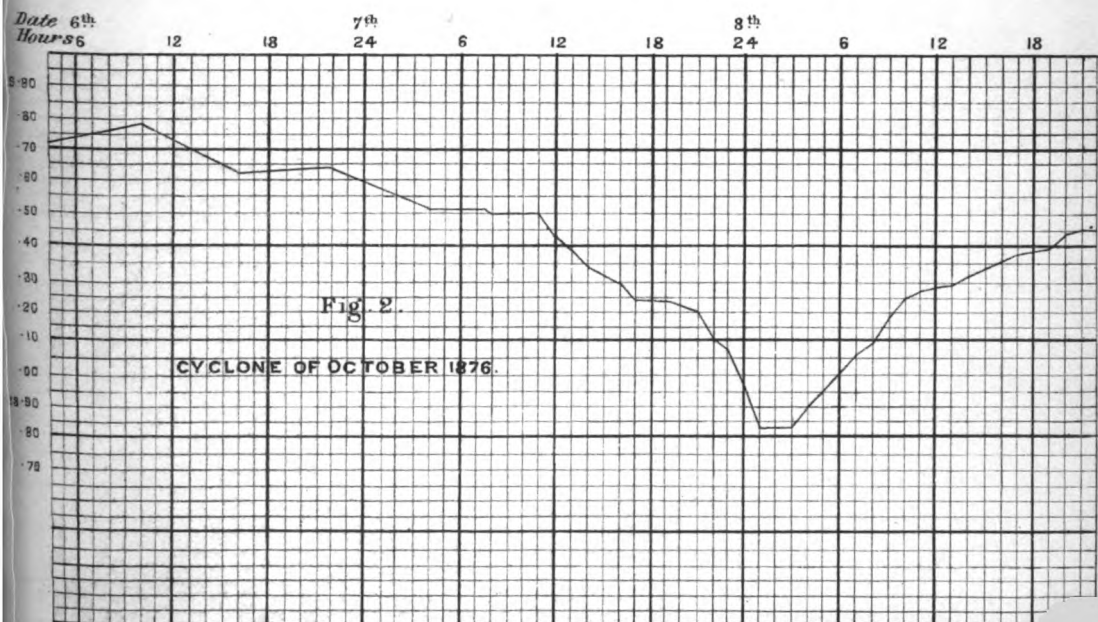
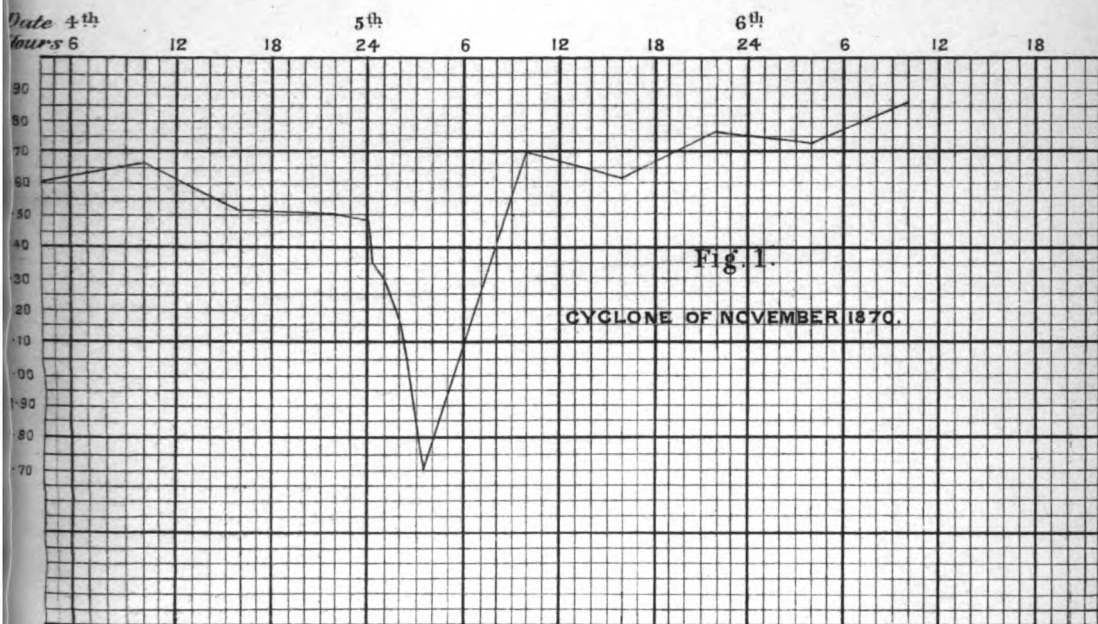


Thermograph

16 17 18 19 20 21 22 23 24

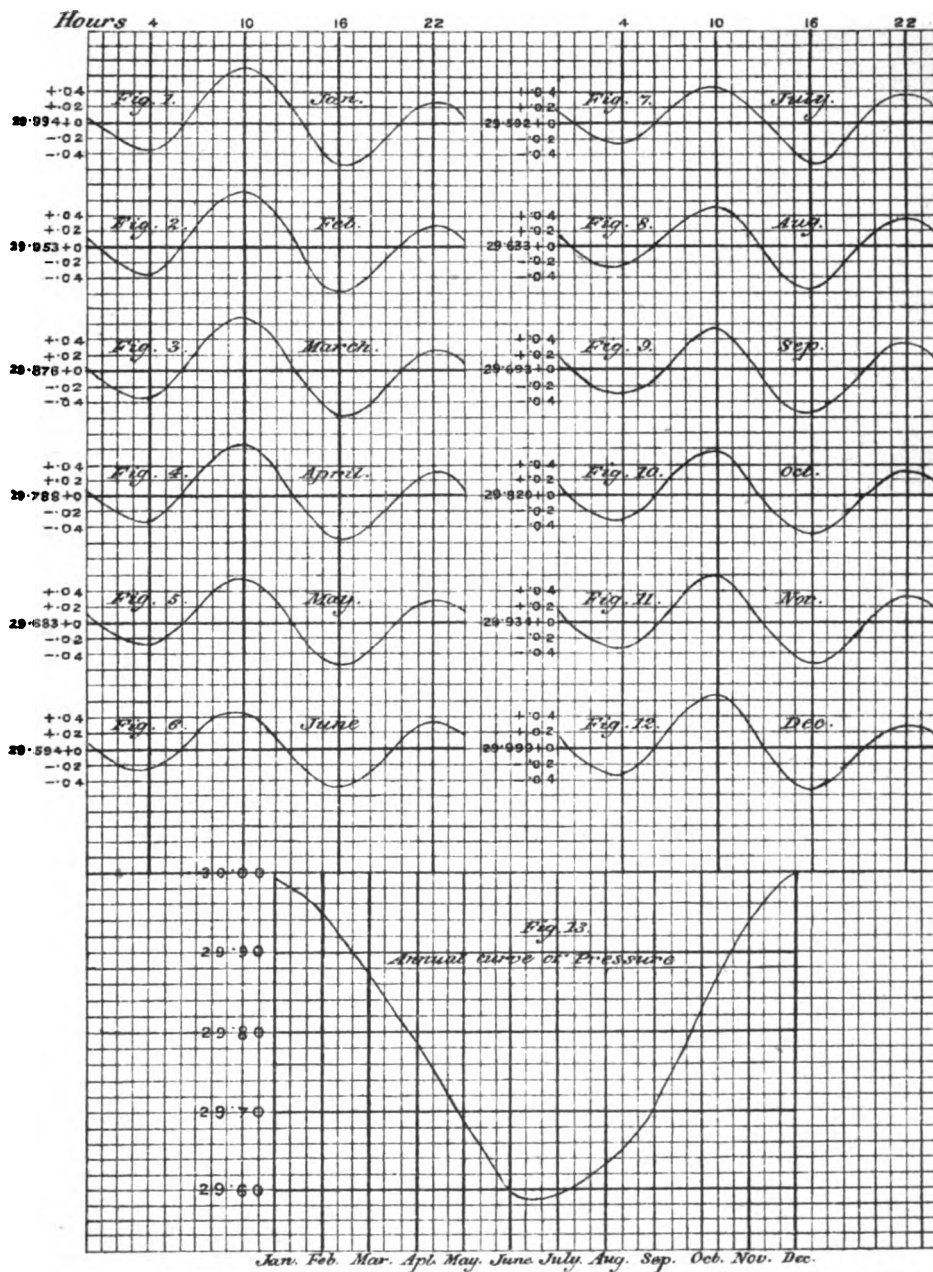








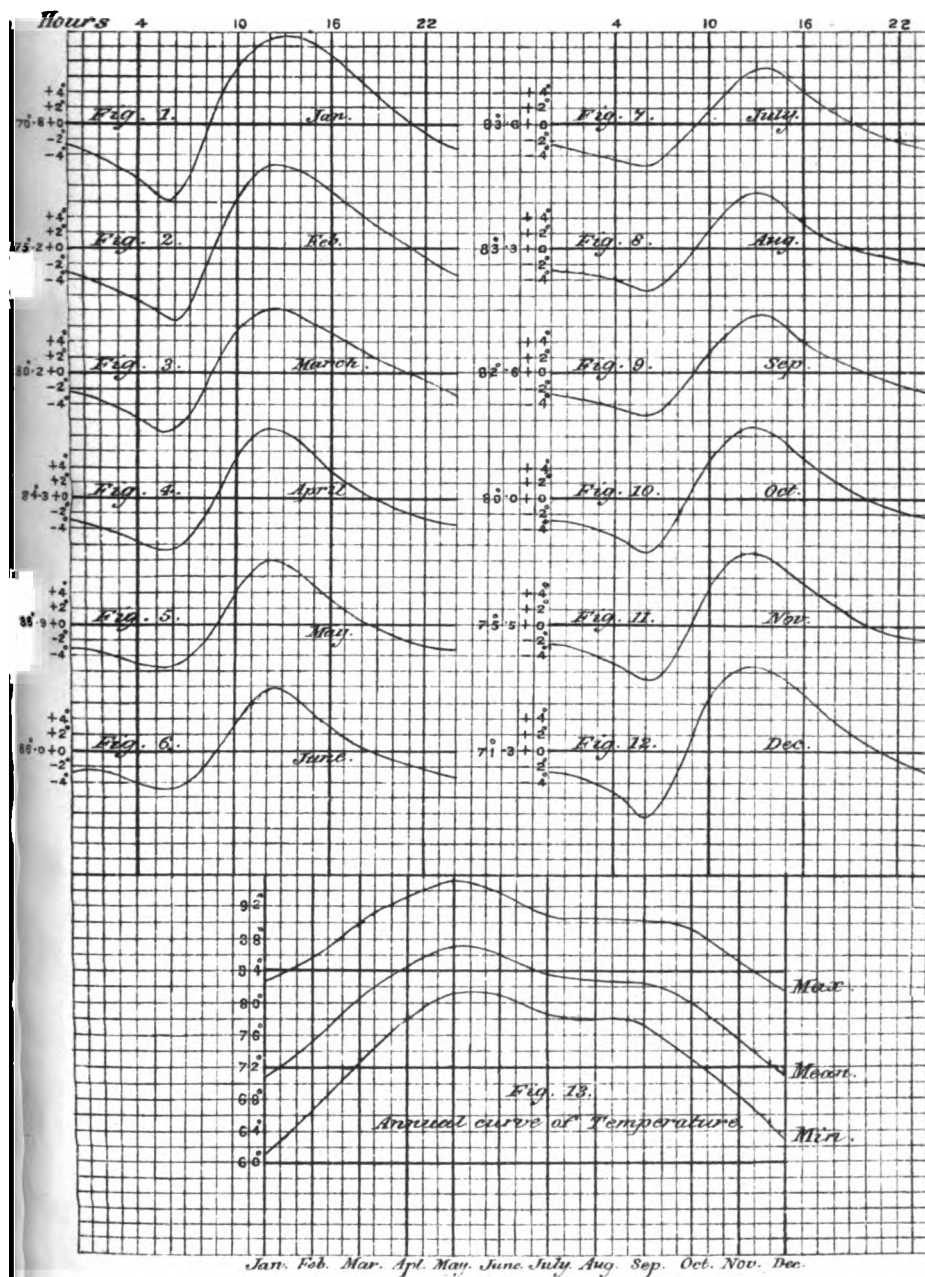
DIURNAL VARIATION OF PRESSURE, VIZAGAPATAM.





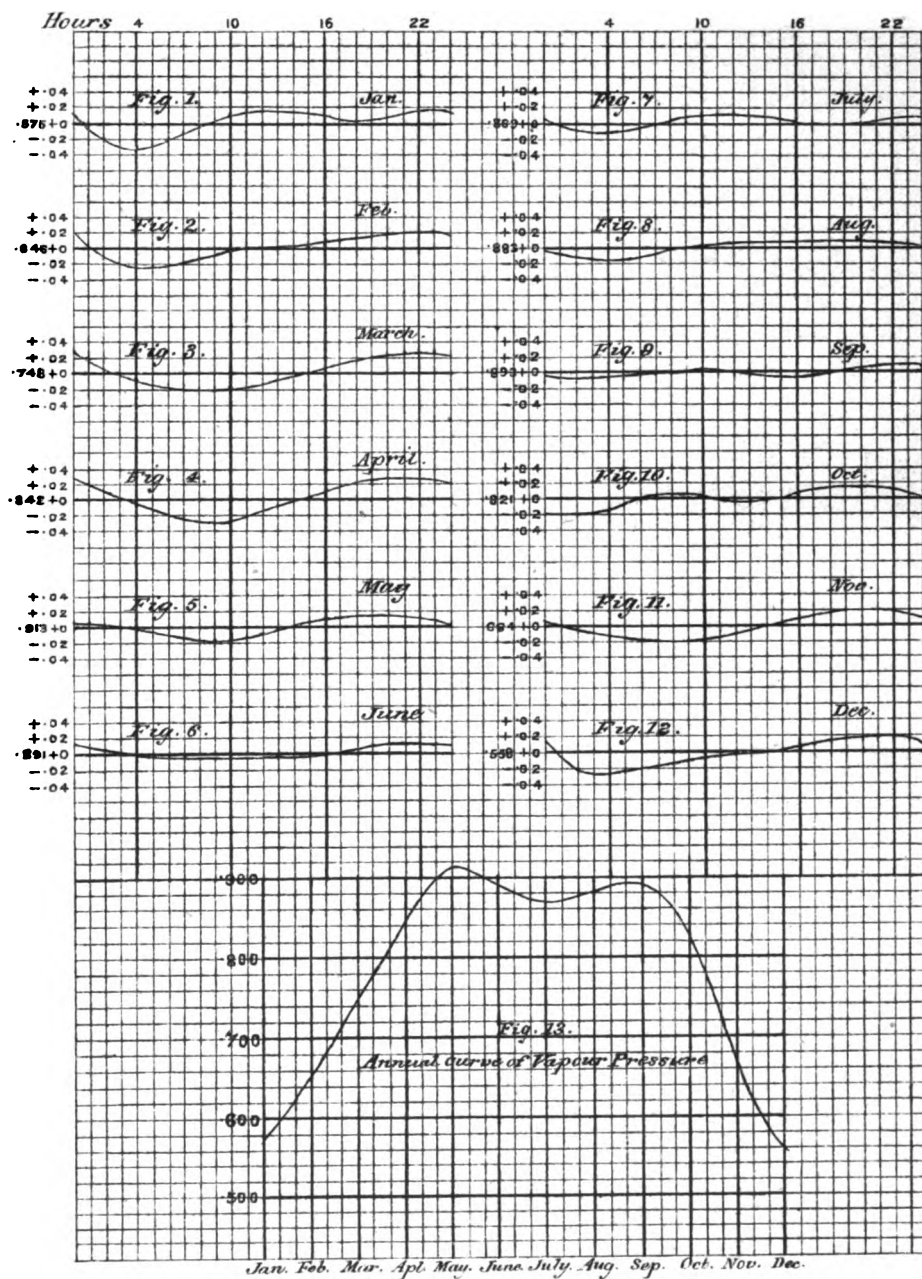


DIURNAL VARIATION OF TEMPERATURE, VIZAGAPATAM.



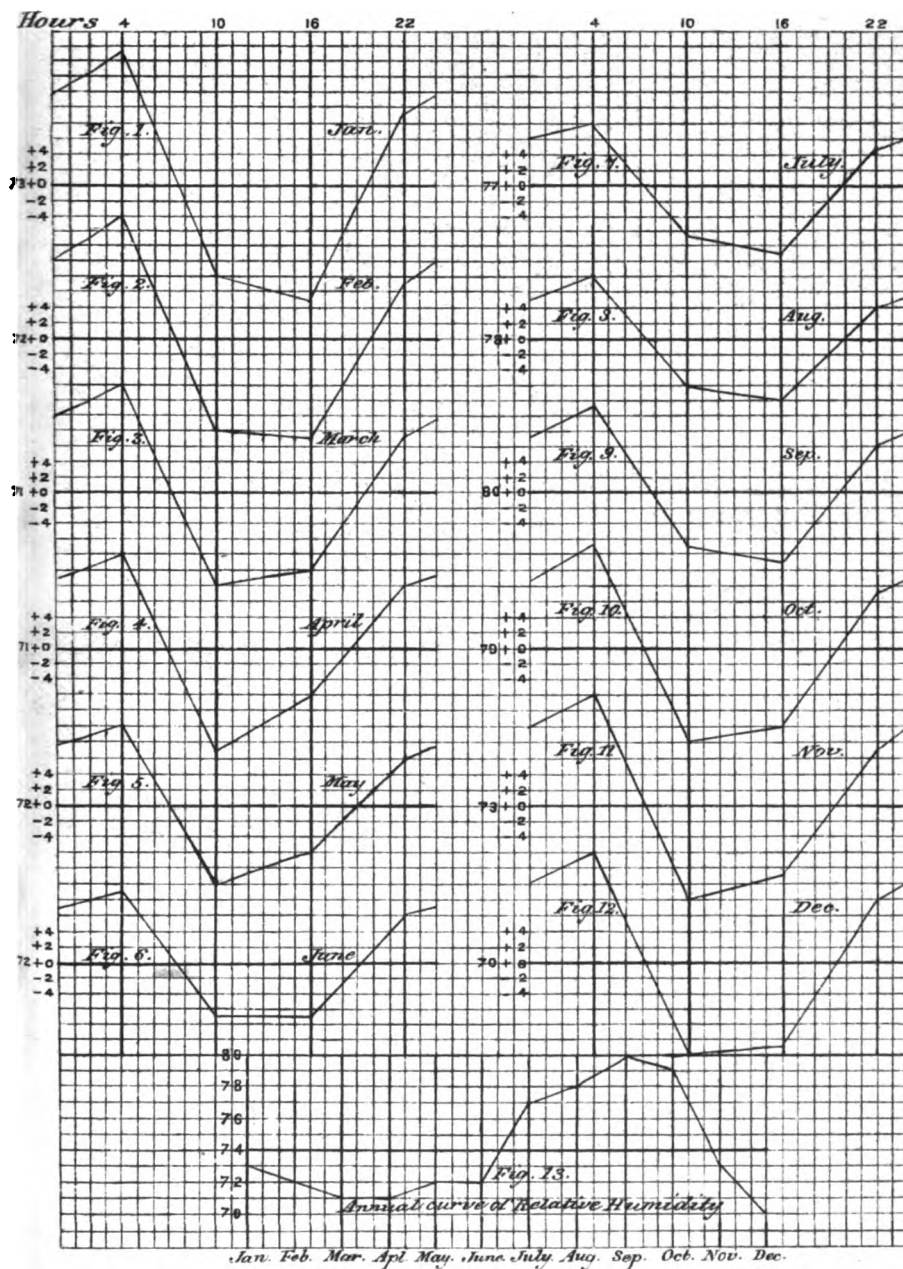


DIURNAL VARIATION OF VAPOUR PRESSURE, VIZAGAPATAM.



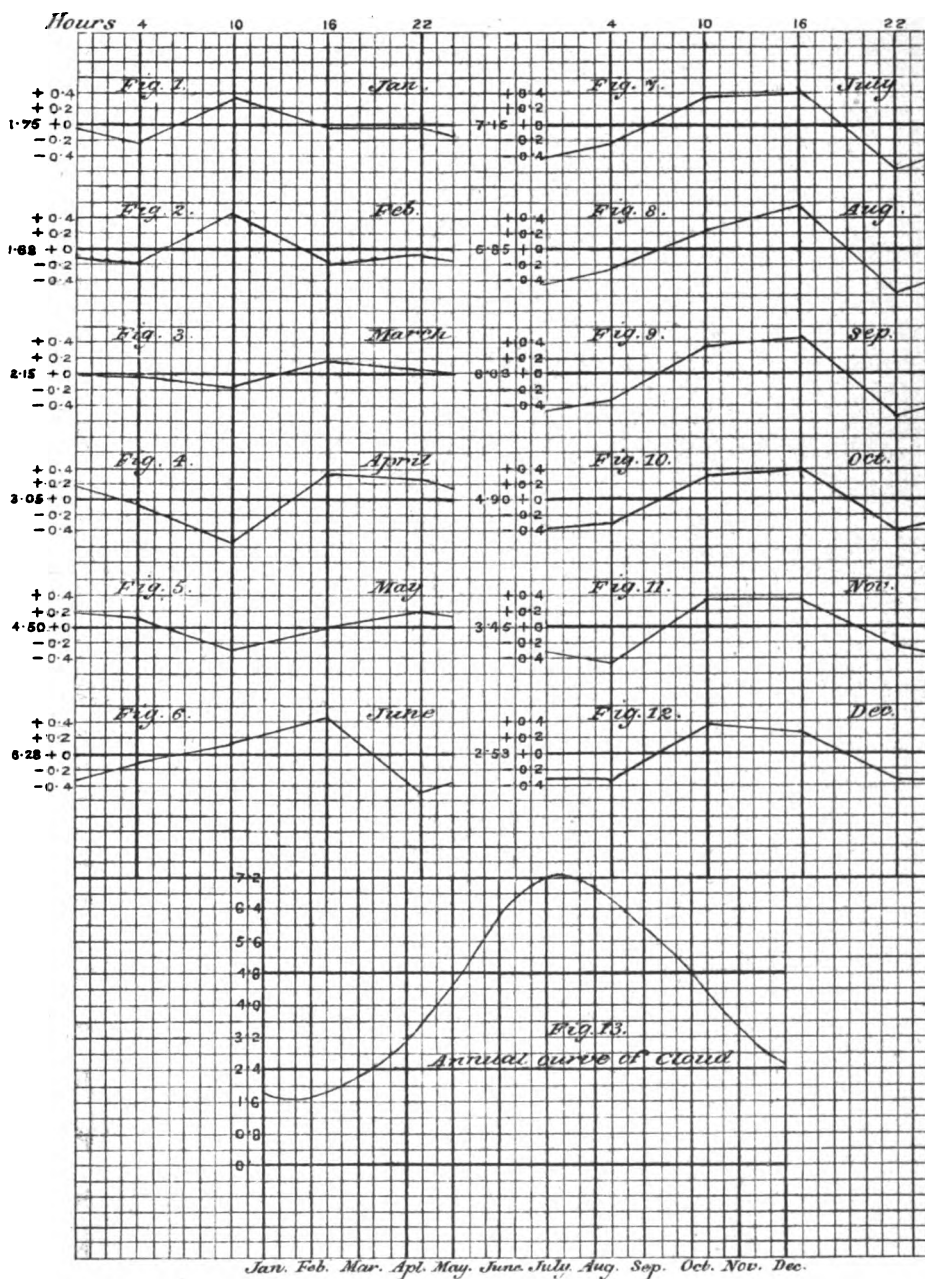


**DIURNAL VARIATION OF RELATIVE HUMIDITY, VIZAGAPATAM.**





DIURNAL VARIATION OF CLOUD, VIZAGAPATAM.







Ph 96458.99

NOTES  
ON THE  
METEOROLOGY  
OF  
VIZAGAPATAM.

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PART I.—RAINFALL.

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BY  
W. A. BION,  
ASTRONOMER, G. V. JUGGAROW OBSERVATORY, VIZAGAPATAM.

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CALCUTTA:  
BAPTIST MISSION PRESS.  
1898.





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NOTES  
ON THE  
METEOROLOGY  
OF  
VIZAGAPATAM.

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PART II.

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BY  
W. A. BION,  
ASTRONOMER, G. V. JUGGAROW OBSERVATORY, VIZAGAPATAM.

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1899.

# PROCEEDINGS

## OF THE

ANNUAL MEETING

OF THE

1907

1907

1907

1907

1907























